DOCUMENT RESUME

ED 101 128 CE 002 874

TITLE Report on Federal Productivity. Volume 2, Productivity Case Studies.
INSTITUTION Joint Financial Management Improvement Program, Washington, D.C.
PUB DATE Jun 74
NOTE 148p.; For volume 1, Productivity Trends, FY 1967-1973, see CE 002 873

EDRS PRICE MF-$0.76 HC-$6.97 PLUS POSTAGE
DESCRIPTORS *Administrative Agencies; *Case Studies; *Federal Government; Government (Administrative Body); *Measurement; National Surveys; *Productivity; Trend Analysis

ABSTRACT

Volume 2 contains 15 productivity case studies which illustrate and expand on the causal factors mentioned in volume 1. The cases illustrate many different approaches to productivity measurement improvement. The case studies are: Development of an Output-Productivity Measure for the Air Force Medical Service; Measuring Effectiveness and Efficiency in the Army Materiel Command; The Effectiveness/Productivity Program in the Defense Mapping Agency; Productivity Measurement in the Defense Supply Agency; Technology Repair Centers in the Air Force; Budget Use of Productivity Measures in the National Labor Relations Board; Productivity Case Study of the Farmers Home Administration; Management Use of Productivity Measures in the Bureau of Engraving and Printing; Productivity Improvement in the Bureau of the Mint; Productivity through Automation in the Bureau of the Public Debt; Improved Measurement of Productivity in Power Operations of the TVA; Productivity Measurement and Quality Evaluation in the Social Security Administration; Productivity Improvement in Clerical Functions of the VA; Improved Productivity in a Regional Office, Bureau of Labor Statistics; and Improving Productivity in Nashville, Tennessee. (Author/NH)

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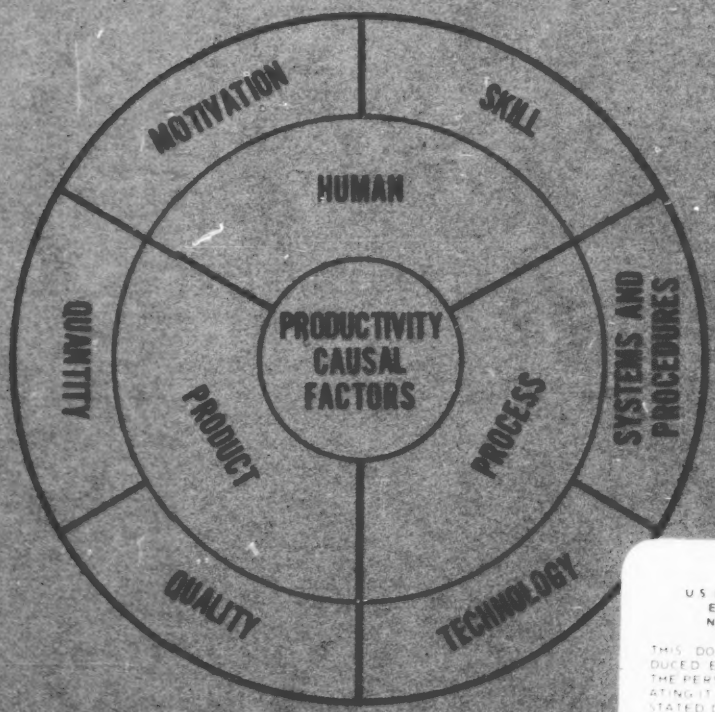
REPORT ON FEDERAL PRODUCTIVITY

VOLUME II

Productivity Case Studies



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JOINT FINANCIAL MANAGEMENT IMPROVEMENT PROGRAM

JUNE 1974

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FOREWORD

In June 1973, a joint project team of the Office of Management and Budget, the Civil Service Commission, and the General Accounting Office submitted its final report on a three-phase project for measuring and enhancing Federal productivity. This study concluded that the productivity measurement system should be made permanent and that an annual report should be submitted to the President and the Congress.

A memorandum of July 9, 1973, to the heads of executive departments and agencies, from the Director of the Office of Management and Budget authorized continuance of the annual productivity review and assigned responsibilities for the continuing program.

The Joint Financial Management Improvement Program has assembled this annual report on Federal productivity. The report is presented in two volumes. Volume I reports on productivity trends for FY 1967-1973 and comments on the causes of productivity increases and decreases. Volume II consists of a series of productivity case studies.

The productivity program is a truly collaborative effort involving the participation of a large number of agencies. Important contributions have been made by the Bureau of Labor Statistics, the General Services Administration, the General Accounting Office, and the Civil Service Commission, as well as the 46 agencies which furnished productivity measurement data and used it in managing their programs. Officials of the agencies involved prepared most of the case studies appearing in Volume II.

This report indicates that considerable progress has been made in the measurement of productivity in the Federal Government but that there are many opportunities for further productivity improvements. We hope that this report will be useful in stimulating increased interest in this important program.

Donald C. Kull

Donald C. Kull, Executive Director
Joint Financial Management
Improvement Program

June 1974

REPORT ON FEDERAL PRODUCTIVITY
VOLUME II
PRODUCTIVITY CASE STUDIES

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VOLUME II

CHAPTER I

INTRODUCTION

Based on recommendations in a June 1973 report "Measuring and Enhancing Productivity in the Federal Government" the Federal Government established a continuing productivity program in 1973.

Leadership in this program is provided by the Office of Management and Budget, the General Services Administration, the Civil Service Commission, the Bureau of Labor Statistics, and the Joint Financial Management Improvement Program.

Productivity data for FY 1967 - 1973 has been furnished by 46 Federal agencies.

This is Volume II of a two volume report. Volume I contains the basic data on productivity for the overall measured segment (61 percent) of Federal employment and for each of the 16 functions into which the data from the 200 separate organizational elements has been grouped. It also contains an analysis of the causes of productivity changes and some conclusions about the program.

Volume II contains 15 productivity case studies which illustrate and expand upon the causal factors mentioned in Volume I. These cases come from a wide variety of Government operations and illustrate many different approaches to productivity measurement and improvement. Some of the cases point up the close relationship between productivity measurement and other management processes. They are not philosophical or theoretical dissertations. Rather, they are statements of what has actually been accomplished in practical operating situations.

One thread running through these case studies is the evidence of enthusiastic and energetic leadership in the organizations involved. This is a vital ingredient for a successful productivity program in any agency. It is hoped that the readers of these case studies will catch some of this enthusiasm and will be inspired to initiate or strengthen productivity improvement programs in their own organizations.

CHAPTER 2

DEVELOPMENT OF AN OUTPUT--PRODUCTIVITY MEASURE FOR THE AIR FORCE MEDICAL SERVICE

BACKGROUND

A. The United States Air Force Medical Service provides medical support of the Air Force mission. It operates 102 hospitals and 42 clinics throughout the world in support of Air Force members and beneficiaries.

B. Air Force medical facilities range in size from outpatient clinics with no inpatient capability to large medical centers with up to 1,000 inpatient beds. Many of these medical facilities are located in rural or remote areas and some are located in the vicinity of metropolitan areas. Air Force hospitals are similar to non-military hospitals in many respects but they also encompass a broader public health or community health role than the conventional community hospital. In general, Air Force hospitals provide the following types of services:

--Inpatient care

--Outpatient & Ancillary care

--Comprehensive dental care

--Preventive medicine program support

--Industrial & occupational health support for various military missions.

Air Force hospitals are linked together and with other Department of Defense hospitals through a system of regionalization whereby smaller medical facilities are supported by specialty services at larger and more comprehensive military medical centers. Air Force beneficiaries also obtain care from the civilian sector when that option more appropriately meets the needs of the military and civilian community.

SOURCE: U.S. Air Force

II. APPROACHES TO PRODUCTIVITY

A. Prior to the 1950's the military health care system used ocupied bed days as a summary output measure. During the early 1950's the adequacy of this measure diminished as length of inpatient care decreased and outpatient medical services expanded. In 1956 as a result of a tri-service study an output measure called the Composite Work Unit (CWU) or Medical Care Composite Unit (MCCU) emerged. The CWU is a composite index that weights patient care workloads as follows:

CWU = Average Daily Beds Occupied +
(Average Daily Admissions x 10) +
(Average Daily Births x 10) +
(Average Daily Outpatient Visits x .3)

B. The Air Force Medical Service believes the CWU is no longer an adequate output measure for hospitals because the index overvalues inpatient care, significantly undervalues outpatient care and ignores ancillary medical care. Accordingly since medical care technology has shifted to an increased emphasis on outpatient care the CWU has become a less responsive index of medical care delivery

C. Recognizing the need for a composite output measure for use in a productivity index the Financial Program Division of the Air Force Surgeon General's office attempted to develop an output measure that was a sensitive measure of the Air Force Medical Services hospital workload. The criteria for the index were: (1) the measure should be derived from existing data bases, (2) the measure should be simple in design, (3) the measure should be consistent over time, (4) the measure should be related to intensity of service, and (5) it should be relatable to input. The output measure developed is called the Adjusted Admission Equivalent (AAE).

D. The Adjusted Admission Equivalent (AAE) is a composite measure with components weighted on the basis of total equivalent unit costs for the base year. The inpatient visits, dental procedures, laboratory procedures, prescriptions, and x-ray films exposed are the additional components. Table 1 details the procedure used to establish relative weights.

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TABLE 1

SURVEY STATISTICS-COST AND WORKLOAD

DETERMINATION OF RELATIVE WEIGHT

	I/P Admissions	O/P Visits	Dental Procedures	Laboratory Procedures	Pharmacy Prescriptions	X-Ray Films Exposed
Cost	$133,970,511	$79,181,943	$38,360,048	$11,057,288	$18,777,885	$9,324,370
Workload Units	339,647	13,695,865	16,272,106	8,832,241	17,660,912	5,755,488
Cost/ Workload	394.44	5.78	2.36	1.25	1.06	1.62
Relative Weights Cost/Admission ÷ cost/ workload	1	68.2	167.1	315.6	372.1	243.5

Table 2 provides an example of how the AAE is constructed for a particular year. As noted in this table the sum of the component contributions is then the Adjusted Admission Equivalent.

TABLE 2

CALCULATION OF AAE FOR FY 1969

(AIR FORCE HOSPITALS)

	Weight Factor	Reciprocal of Weight Factor	X	FY 1969 Workload	=	Adjusted Admission Equivalent
I/P	1	1		339,647		339,647
O/P	68.2	.015		13,695,865		205,438
Dental	167.1	.006		16,272,106		97,632
Laboratory	315.6	.003		8,832,241		26,497
Pharmacy	372.1	.003		17,660,912		52,983
X-Ray	243.5	.004		5,755,488		23,022
						745,219

E. Once the output measure was developed it was related to input factors (i.e., man-years and dollars) in the conventional manner to create a productivity index.

APPLICATIONS OF THE ADJUSTED ADMISSION EQUIVALENT (AAE)

A. Since the Adjusted Admission Equivalent is a relatively new measure within the Air Force its actual use to date is rather limited. It was used in the Air Force submission to the Federal Productivity Program in December 1973 and the input is considered to be a reasonable approximation of the Air Force Medical Services' productivity. Additionally, the AAE is being studied for internal use as a productivity measure for various medical facilities within the Air Force and consideration is being given the possibility of presenting Air Force hospitals' workload in terms of the AAE to the Office of the Secretary of Defense and the Office of Management and Budget during budget hearings.

B. The AAE is being actively developed as an internal measure of the productivity of various medical facilities within the Air Force. A preliminary computerized analysis of input and output data has been developed in the Surgeon General's office to identify changes in the relative productivity of each of its medical facilities and to highlight those facilities where relative productivity changes are beyond accepted norms. It is anticipated that this technique will assist the Surgeon General in identifying areas of marginal productivity and to apply corrective measures when such action is appropriate. The analysis uses a modified Adjusted Admission Equivalent (MAAE) as the output measure (MAAE is the same as AAE except it excludes dental workload because this data is not currently accessible by location on an automated basis). The analysis indicates the index of change in workload by facility for specific periods of time and relates these changes to changes in the total man-year and physician man-year composition of each facility (see Table 3).

Table 3

MODIFIED ADJUSTED ADMISSION EQUIVALENT, PCN-LD0o6SA

1st CUM QTR FY 1974	MODIFIED ADJUSTED ADMISSION EQUIVALENT (MAAE)			(MAAE) PER TOTAL MAN YEARS			(MAAE) PER PHYSICIAN MAN YEARS		
	1st CUMULATIVE FY 74	QUARTER FY 73	INDEX OF CHANGE	1st CUMULATIVE FY 74	QUARTER FY 73	INDEX OF CHANGE	1st CUMULATIVE FY 74	QUARTER FY 73	INDEX OF CHANGE

(Sample format)

OUTLOOK FOR THE FUTURE

A. The AAE, although a more representative measure of output than the CWU, may be further refined. For example, the present AAE treats all admissions the same and while it recognizes additional ancillary workload associated with complex admissions it may not give adequate attention to increased nursing requirements. Another technical limitation is related to the fact that all laboratory or x-ray procedures may not be the same. It is possible to substitute weighted laboratory procedures or weighted x-ray procedures for the present unweighted workloads and the Air Force Medical Service is developing a data base along these lines. In the future it may also be possible to provide weights to the type of admission or type of outpatient visit.

B. It should be noted the AAE is still quite primitive as an output measure and considerable improvement can be made when weighted workloads are included in medical information systems. In addition, the use of any output measure will be limited unless there are effective mechanisms for monitoring the manipulation of output of each of the components.

Professional Standard Review Organizations (PSRO) and Utilization Review Committees can, in theory, monitor this problem of overutilization of medical care.

CHAPTER 3

MEASURING EFFECTIVENESS AND EFFICIENCY IN THE ARMY MATERIAL COMMAND

The purpose of this report is to present the status of the Productivity Improvement Program within the Army Materiel Command. Approximately one year ago AMC began an investigation to determine the potential benefits of productivity concepts within the command, and soon found an astounding array of very beneficial managerial tools. In one year the program has emerged from the conceptual stages into a detailed evaluation and analytical system. To best explain the rapid progress of the program, this report is divided into sections for Background, Effectiveness Measurement, Efficiency Measurement, and a Summary which will also project future actions for the system.

BACKGROUND

The U.S. Army Materiel Command consists of a nationwide network of 78 military installations and more than 100 operating activities. It is responsible for all life cycle material functions which include research and development, test and evaluation, procurement and production, storage and distribution, inventory management, maintenance, and disposal. With headquarters in Washington, D.C., AMC operates through seven major subcommands and directs the activities of depots, laboratories, arsenals, maintenance shops, proving grounds, test ranges, and procurement offices throughout the United States.

The U.S. Army Materiel Command has management responsibility for an inventory of approximately $12 billion in 19 depots; $6 billion of stocks on order from procurement sources; $16 billion in ammunition and other major items in the hands of troops or overseas depots; and an annual expenditure of approximately $7 billion. It directly employs 10,000 military and 120,000 civilian personnel.

SOURCE: Army Materiel Command

In short, AMC's business is to develop and manage the hardware of the Army; the mission is to achieve the highest possible degree of materiel operational readiness. AMC's Effectiveness and Efficiency Evaluation System provides the indicators to gauge total performance.

EFFECTIVENESS

Before explaining the mechanics of the Effectiveness Evaluation System, it is first necessary to make a distinction between effectiveness and efficiency. In general terms, effectiveness measures how well an activity is accomplishing its mission. Performance efficiency, however, is a measure of how well a commander utilizes his resources in accomplishing that mission. Performance evaluation is therefore measured from two different viewpoints. It is imperative that the degree of mission (goals, objectives, etc.) accomplishment be measured (effectiveness), but during a peacetime which is characterized by austere resources, it is equally important to evaluate the resource utilization picture (efficiency). Actual performance from the two systems must be integrated to evaluate total performance.

The Effectiveness Evaluation System considers long-term trends, cyclic or seasonal influences, and is based on long and short range objectives, goals, or targets established by Congress, the Department of Defense, the Department of the Army, or AMC itself. The evaluation rests on a continuing surveillance of several dozen performance and quality indicators in essential mission areas. Each quarterly presentation covers a selection of those indicators, showing significant trends or deviations from expected or desired norms. (See figure 1.)

FIGURE 1

PERFORMANCE EFFECTIVENESS

COMMANDS

1. MATERIEL ACQUISITION
   - PROCUREMENT CONTRACTS
   - ON-TIME DELIVERIES
2. LOGISTICS SUPPORT
   - STOCK AVAILABILITY
   - OP. READINESS
3. CIVILIAN PERSONNEL
   - PERS. MANAGEMENT
   - EEO

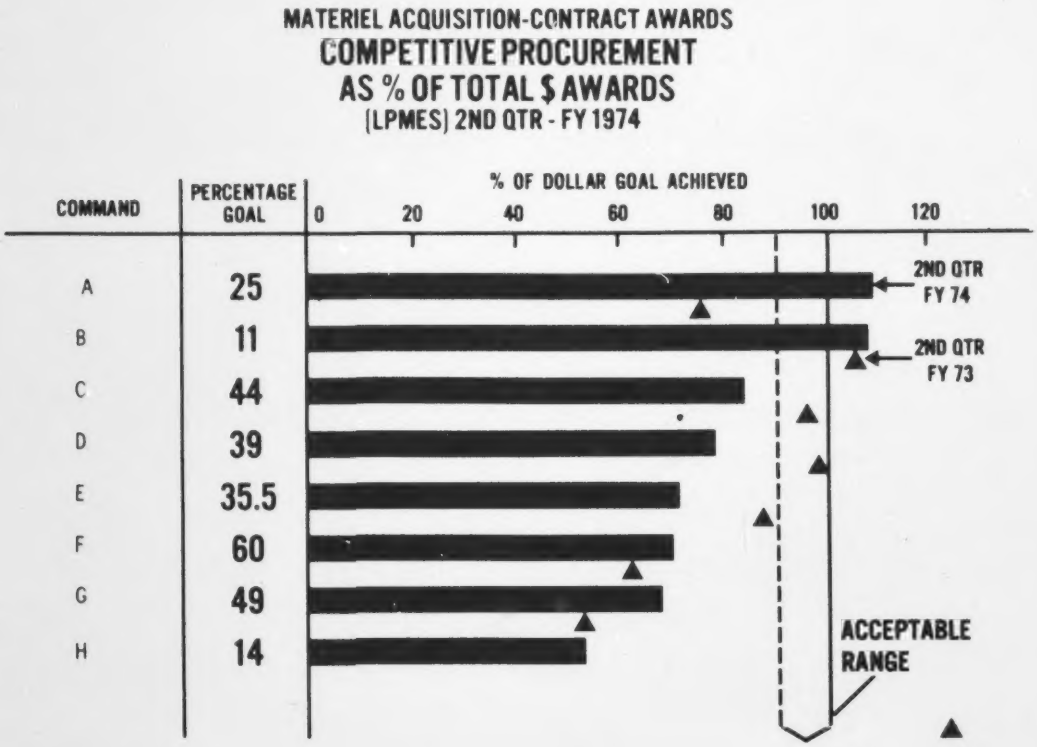
DEPOTS

1. SUPPLY OPERATIONS
   - ON-TIME SHIPMENTS
   - MAT'L. RELEASE DENIALS
2. MAINTENANCE OPERATIONS
   - COMPLETIONS VS. SCHEDULED
   - QUALITY REJECT RATES
3. CIVILIAN PERSONNEL
   - PERS. MANAGEMENT
   - EEO

This chart presents only a sample of the indicators used within the system. Different sets of indicators are used for the various types of subordinate activities (commands and depots, for example). The indicators are structured into the major mission functional areas so that the analysis provides an overall evaluation of performance effectiveness. This approach also serves to isolate problem areas for in-depth analysis and to identify the specific causes or specific subordinate elements responsible for deviant performance, so that proper corrective action may be taken.

The following charts are examples of performance indicators used within the system.

FIGURE 2



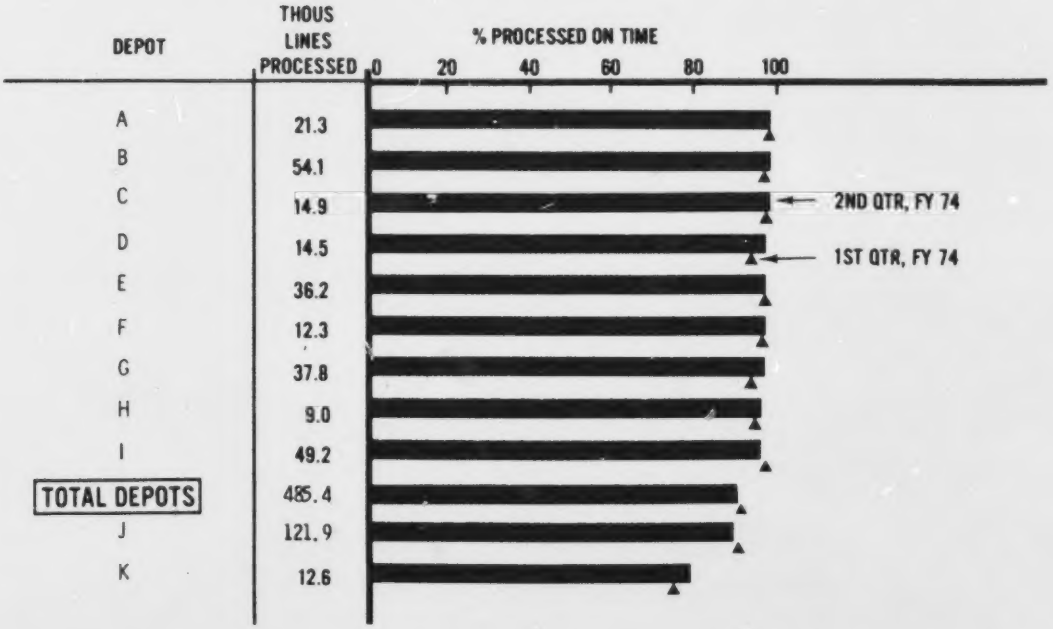
As shown in figure 2 each command has an individual goal in achieving a larger percentage of competitive-bid contracts in comparison to total contracts awarded. An acceptable tolerance range of 90-100% is shown for meeting the independent goals.

FIGURE 3

SUPPLY

DEPOT MRO PROCESSING

TOTAL ISSUES-ALL IPGS-2ND QTR FY 74



Depots are expected to process material release orders (MRO's) within specified time frames. The time goals for on-time processing are related to the priority of the supply requisition from the soldier in the field. The higher the priority of the soldier, the shorter the time frame for the depot to ship the supplies. The goal is to ship 100% of all MRO's within the times specified by Department of Defense. Figure 3 above shows this data for AMC depots.

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FIGURE 4

EQUAL EMPLOYMENT OPPORTUNITY
AVERAGE GRADE DIFFERENCES - COMMANDS & HQ
RECAP

30 JUN 73 - 31 DEC 73

(GOAL: REDUCE AVG GRADE DIFFERENCE BY 5%)

HQ & COMMANDS	WEIGHTED COMPOSITE SCORE	% OF GOAL ATTAINED				
		WOMEN OVER GS-5	MINORITY CLASS ACT	MINORITY WG, NON-SUPV	MINORITY WG LDR	MINORITY WG SUPV
A	94	-28	71	188	48	179
B	12	-14	30	NONE	NONE	NONE
C	244	-66	62	556		4
D	166	41	246	8	-113	-513
E	160	-97	252	249	-77	174
F	149	-33	139	297	93	-91
G	108	-8	130	155	102	3
H	80	74	81	98	162	57
I	-40	2	-60	5	-10	

In addition to covering mission activities, the system also addresses resource oriented areas in which AMC has goals. An example would be the Equal Employment Opportunity Program where numerical goals have been established for each sub-element. The goal is to reduce the average grade differences by at least 5%. The numerical scores represent the percentages of the goals which have been attained. It should be noted that negative scores appear, thus the average grade difference has increased rather than decreased. (See figure 4 above.

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FIGURE 5

AMC OVERALL PERFORMANCE INDICATOR REVIEW

DEPOT PERFORMANCE SUMMARY (MAJOR DEPOTS)

SELECTED INDICATORS

SECOND QUARTER FY 1974

	WT	A	B	C	D	E	F	G	H	I	J	K
MAINTENANCE ITEMS COMPL vs SCHEDULED	25	1255	760	1965	2500	1835	635	865	1535	1150	1713	1690
FINAL INSPECTION REJECT RATE	5	715	500	675	995	835	1000	675	665	705	585	670
SUB-TOTAL MAINTENANCE	(30)	(1970)	(1260)	(2640)	(3495	(2670)	(1635)	(1540)	(2200)	(1855)	(2298)	(2360)
CIV PERSONNEL MANAGEMENT	9	968	835	1018	920	871	1053	1174	1118	1003	801	1032
EQUAL EMPLOYMENT OPPORTUNITY	1	4	53	39	37	100	87	30	51	95	200	200
SUB-TOTAL PERSONNEL MGMT	(10)	(964	(888)	(1057)	(957	(771	(1140	(1204	(1067	(1098)	(1001)	(1232
SUB-TOTAL SUPPLY	(60)	(5835	(4166	(5640)	(5668)	(5500)	(5741	(5652	(4954	(5664	(5557)	(5199)
TOTAL ·····	100	8769	6314	9337	10120	8941	8516	8396	8221	8617	8856	8791

· MEAN VALUE

·· MAXIMUM VALUE ALLOWED

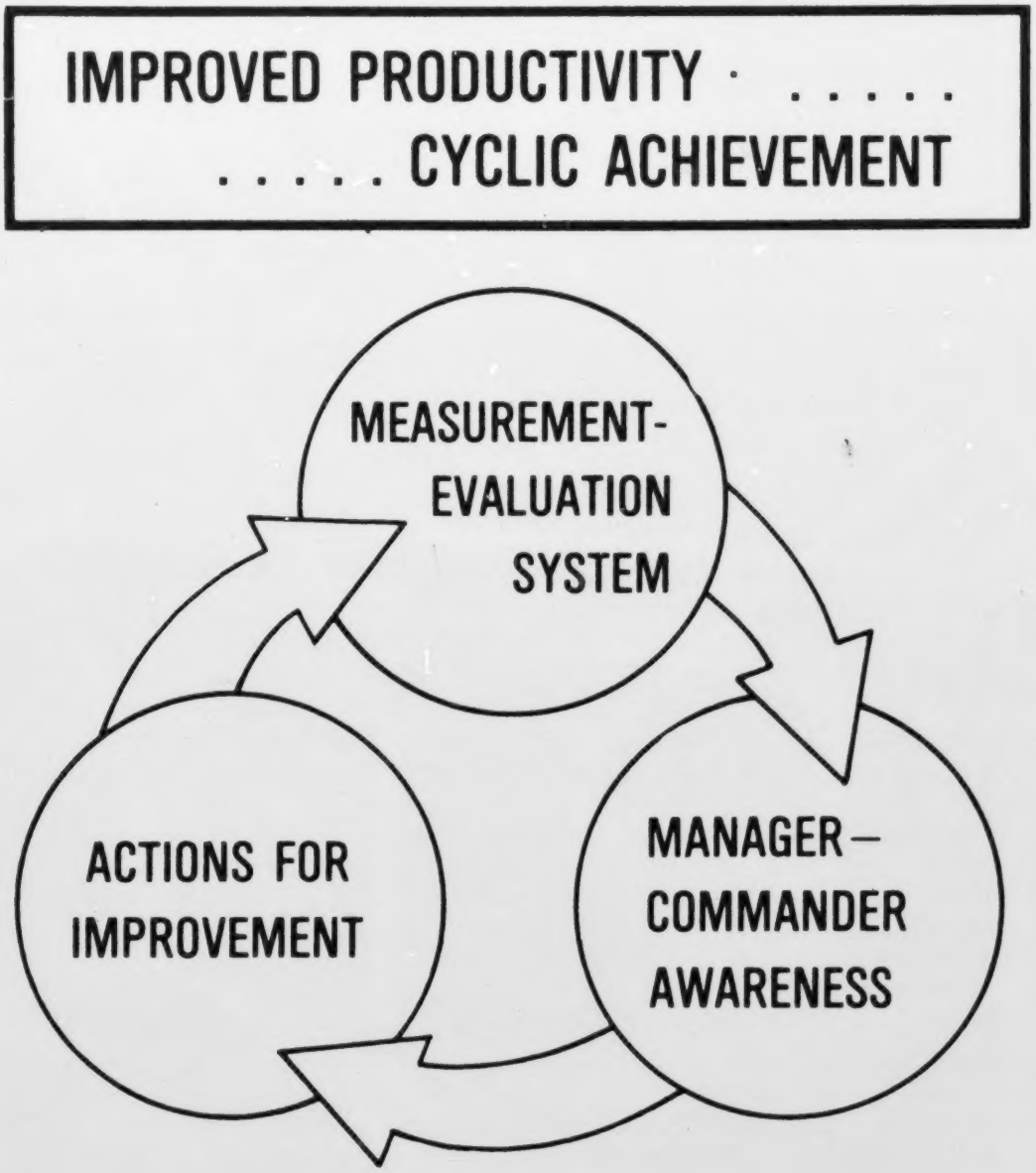
Figure 5 shows that each indicator within the system includes quantified results, or points. It is therefore possible to develop overall effectiveness rankings which compare the various indicators with their counterparts--depot to depot, command to command. This is done through a weighted ranking matrix, as shown on this chart. The composite of the weights constitutes the relative score, and the overall rank for each field element is readily determined. The total points scored will be used later when the Effectiveness and Efficiency Systems are merged into one combined score.

Many ingredients are involved in the Effectiveness System other than the few indicators portrayed in this overview. Adverse performance triggers in-depth analyses to determine the causes behind the problems and to recommend necessary corrective actions. Additionally it should be noted that changing the weights of indicators provides a convenient means for establishing priorities. Analysts therefore strive to maintain system stability while simultaneously promoting areas of command emphasis by assigning more weight to the

related indicators. In summary, the Effectiveness Evaluation System is an accepted, beneficial managerial tool within AMC to evaluate mission accomplishment.

EFFICIENCY

FIGURE 6



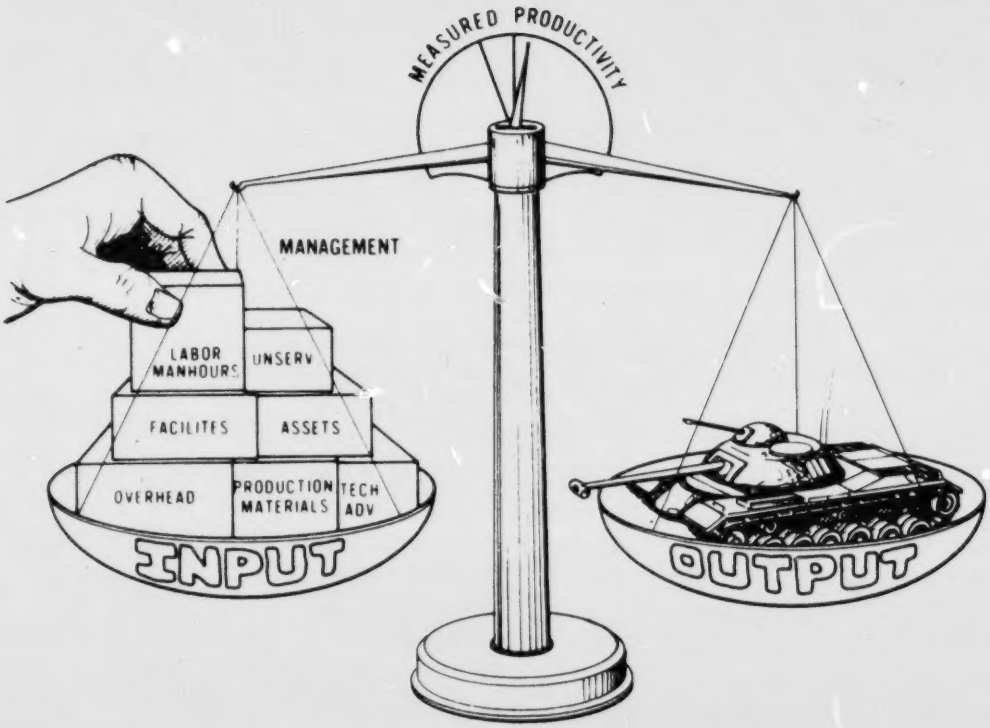
When the original concept of Efficiency Evaluation was formulated, it was envisioned that improved productivity would be achieved in a cyclic manner. The three elements of the cycle are shown on this chart. The first phase was to develop a measurement/evaluation system. This phase is complete; however, AMC continues to refine the parameters of the system.

The second phase of the cycle was to make the manager/commander aware of his productivity, both by himself and in relation to other, similar activities. This phase was initially accomplished with briefings and pamphlets, but has now been expanded to two related programs. The "Management By Objectives" Program is enthusiastically underway within AMC, and one of the goals is to improve resource utilization. The Efficiency Evaluation System will be used to monitor the achievement of improved productivity. The productivity concept has additionally been adopted by AMC budgeting personnel to forecast and justify all budget submissions from subordinate AMC activities, and submissions to Department of the Army. Portrayal of the productivity picture (workload versus resources required) in the budgeting process has improved the accuracy and clarity of justifications for resources.

The third phase of the cycle includes those actions to improve productivity. The actions which are now underway include the Capital Investment Project at AMC's ammunition plants and depots. This project, which has attracted attention throughout all government levels, and Congress, has a great deal of potential for productivity improvements through capital investments. A second project is the human motivational concepts being explored by two depots. This project is parallel to some of the innovative management concepts (job enrichment, job satisfaction, team concept, etc.) being used by industry (Volvo, etc.) whereby people become productive by being better motivated.

The loop is then closed . . . . with implementation of improved productivity actions it is again time for measurement/evaluation. What constitutes the measurement system?

FIGURE 7



Productivity measurement is the cornerstone of efficiency evaluation. Figure 7 shows the input-to-output relationship of productivity measurement. The hand of management on the left places resource blocks on the scale to produce the hardware on the right side of the scale. The objective is to tilt the scale so as to get more output in relationship to the inputs injected into an activity's operation. Measuring productivity at the top of scale becomes the objective of the Efficiency Evaluation System.

Productivity measurement relates the number of men and amount of dollars required to produce certain workload factors over time. For example, the number of men and the amount of constant operating dollars required to produce one unit of workload in the base period (FY 1969) are related to the amount of men and dollars required to produce that same workload factor in a current year. The relationship between the resources expended in a current year versus the base year is shown as a productivity index of both men and dollars. A productivity index above 1.0 shows that more workload is being obtained for the resources expended. In other words, a productivity index reflects the utilization of resources now in relation to the base period.

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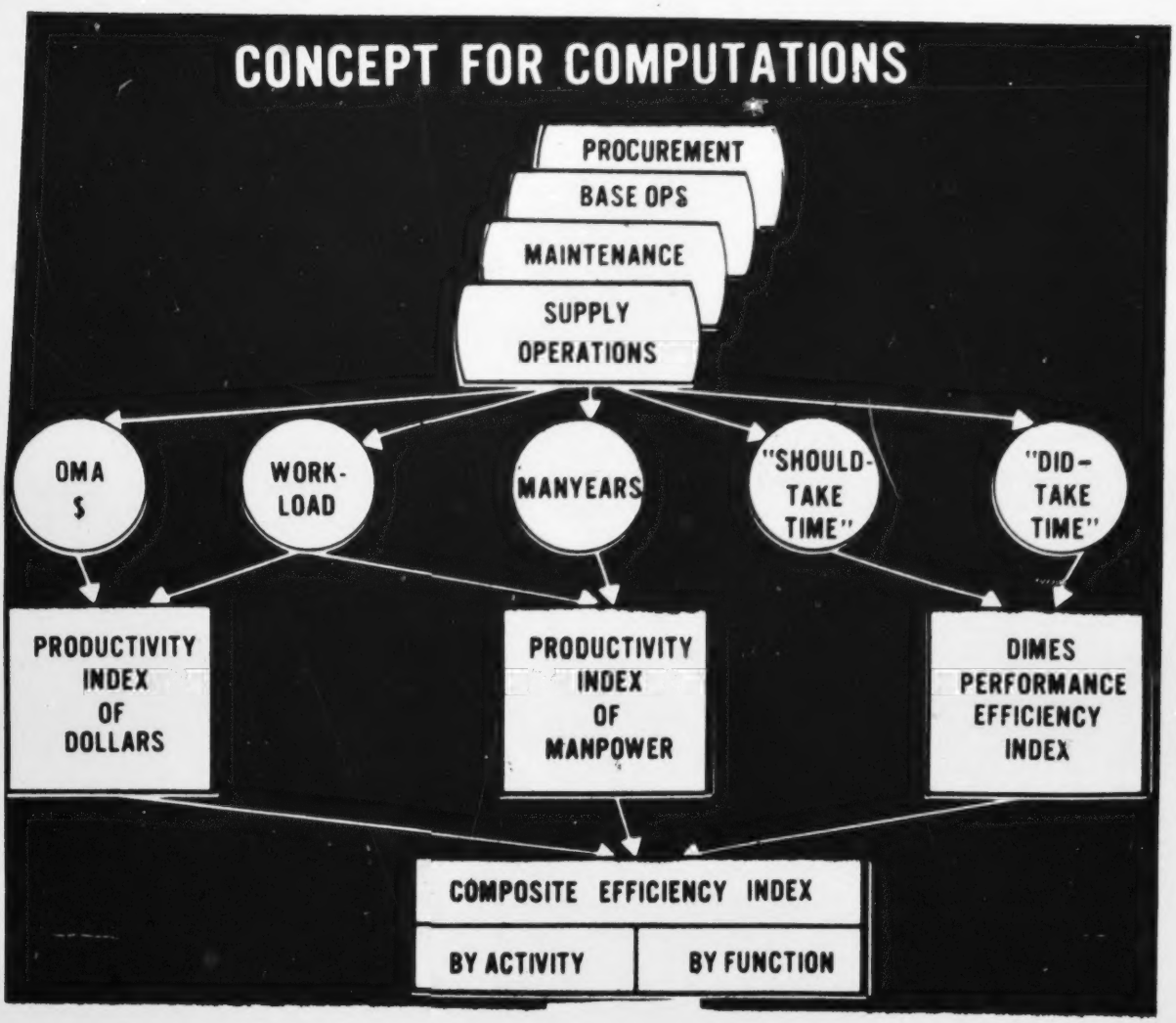
With this concept of productivity measurement the following model was developed to evaluate the efficiency of AMC's subordinate activities. (See figure 8.)

FIGURE 8



This chart shows the concept for developing a composite efficiency index. From each of the four functional areas shown (Supply, Maintenance, Base Ops, and Procurement) five basic data elements are extracted. From the Budget System come the total constant operating dollars, selected factors reflecting workload accomplished and the manyears associated with the various workload performance factors. From the DIMES (Defense Industrial Management Engineering System) Program, the standard or "Should-take" times are compared to the actual, or "Did-take" times. This relationship between how long it should have taken to do a job as defined by Categor I (Engineered) or Category II (Statistical) performance time standards, and the actual hours expended, forms the DIMES Performance Efficiency (PE) index. Comparing the dollars expended for each unit of work accomplished in the base year, with the dollars expended in the current year, produces a productivity index of dollars. The same relationship between manyears and workload in the base year, and the ratio of men to work accomplished in the current year, provide a productivity index of manpower. There now are three efficiency indexes; the productivity indexes of dollars and manpower, and the DIMES PE index. These three indexes are averaged into a composite efficiency index, which is developed for each functional area, and in summary for all functions evaluated, thus becoming the activity efficiency index.

Evaluation and analysis are facilitated by this model. If a certain activity's composite efficiency index trend is downward, it is possible to pinpoint the cause(s) of the adverse trend so that the actions necessary to improve efficiency can be identified.

The true benefits of a system are realized through the degrees of usefulness to managers at numerous organizational echelons. Several examples are already available from this newly developed system. The illustration in figure 9 will give evidence of the realized benefits of the system.

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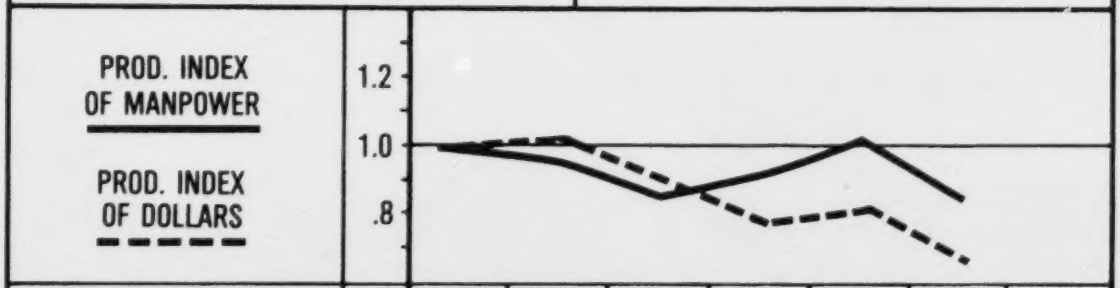
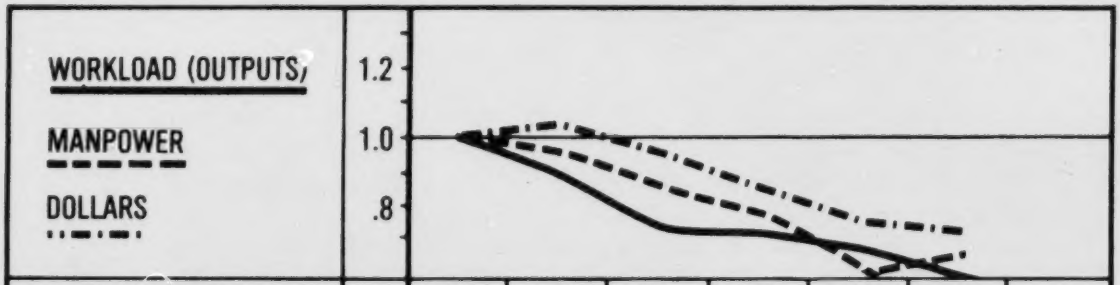
FIGURE 9

SUPPLY MGT	COMMAND "F"



FISCAL YEAR	69	70	71	72	73	74
PI/MANPOWER	1.000	.942	.827	.917	1.008	.837
PI/DOLLARS	1.000	1.006	.881	.784	.838	.684



FISCAL YEAR	69	70	71	72	73	74
WORKLOAD INDEX	1.000	.910	.705	.702	.623	.542
MANPOWER INDEX	1.000	.966	.852	.766	.613	.643
DOLLARS INDEX	1.000	1.027	.948	.864	.766	.737

The top portion of this chart reflects the 5-1/2 year trend for both productivity indexes. It can be seen that both are on a decline, and that both indicators parallel each other. The parallelism is not always true, as other functions/activities have differences between the two productivity indexes. Manpower productivity, for instance, could have an upward trend (which is desirable), but what lies behind the rise? In certain cases, it was found that the improved manpower productivity had been realized by acquiring contractual services to perform a portion of the total workload. The increased manpower productivity was misleading even though the same amount of workload had been performed with fewer men. The check-and-balance feature inherent within this system is that such misleading performance is "caught" with dollar productivity analysis. The increased cost of the contractual services would be shown with a declining dollar productivity index which counter-balances the increase in manpower productivity. This form of evaluation promotes still further analyses to determine if it was economically beneficial to replace in-house capability with contracted services, and makes managers conscious of the economic impacts of managerial decisions. This consciousness is a new dimension for many governmental managers. "Production" rather than "productivity" has sometimes seemed to be management's sole concern, but now . . . . improved productivity is a facet of today's management actions which will have profound effects on the future of AMC activities.

A specific case of measurable benefits generated by the system is shown on this chart. The downward productivity trends (both manpower and dollars) cause a "red flag" to appear, and "why" type questions are asked. The causes behind the downward trends are shown in the bottom half of the chart. Workload now represents only 54% of what it was in the base year. Manpower and dollar resources have been on a decline, but not as rapidly as workload. The solution was either to increase workload, or reduce the amount of inputs into this operation. Workload is nearly uncontrollable since it primarily represents supply requisitions submitted by troop units in the United States and around the world. The other alternative was to reduce resources, and this was the action taken. Reductions can be quantified with the system to determine the number required to achieve a positive productivity picture in relation to the base year, or at least an improved productivity picture from period to period. In this manner, productivity has been linked to the budgeting process to determine resource requirements in future years.

All corrective actions must be related to the effectiveness system to project the impact on mission accomplishment.

MERGING OF EFFECTIVENESS AND EFFICIENCY

The relationship between effectiveness and efficiency, which each manager must be aware of, is shown on figure 10.

FIGURE 10

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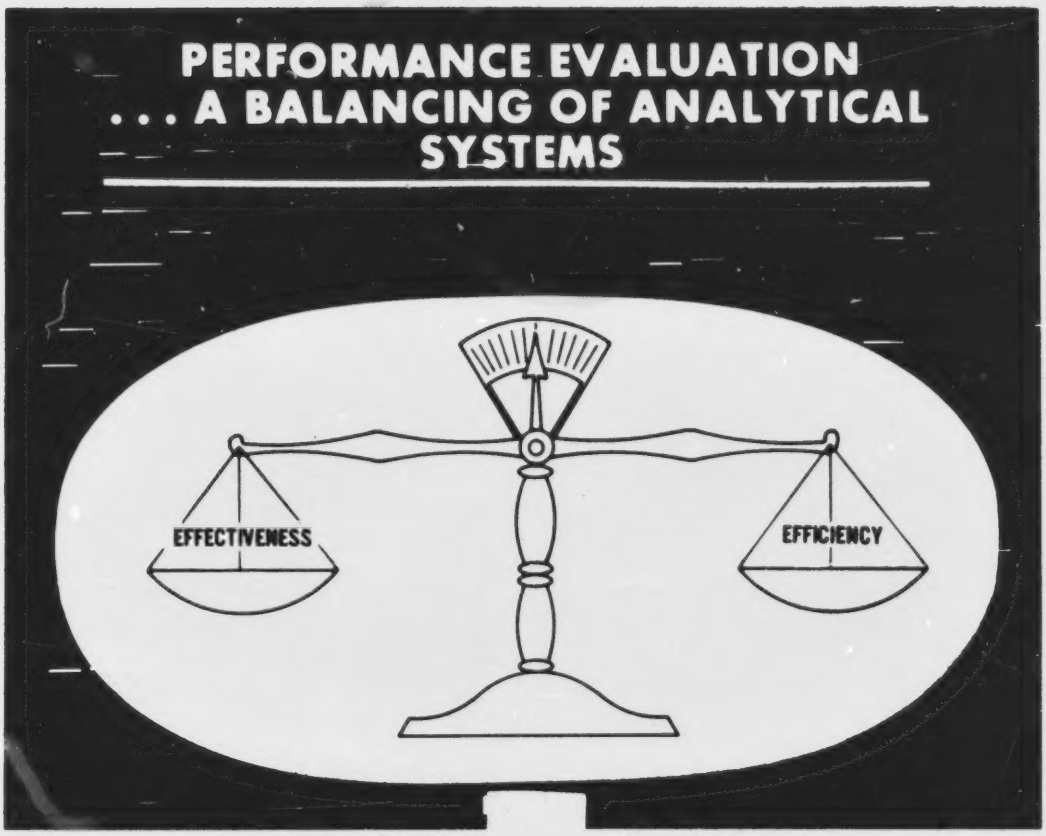

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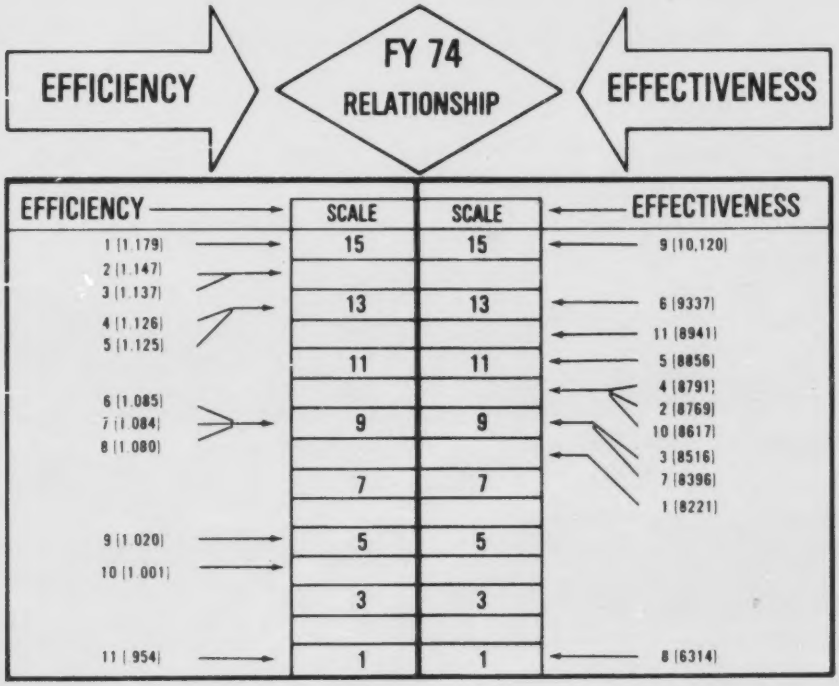
A unique feature of the system is the technique to merge efficiency and effectiveness performance into one combined score. Effectiveness reflects how well the mission is being accomplished, and efficiency shows improvement in utilization of resources. Merging the results of the two independent systems into one score gives an indication of total managerial performance.

In the past managers have all too often managed their operations with only an effectiveness yardstick. Efficiency measures may have been recognized, but were never a real consideration as operational managerial tools. Efficiency is rapidly becoming a part of every manager's philosophy, and is being practiced at numerous managerial echelons.

The scale must be balanced between effectiveness and efficiency, especially in a peacetime environment which is characterized by austere resources. It is now imperative that optimum resources utilization be achieved. The balancing concept is a reality . . . . . AMC must accomplish the mission (effectiveness), and do the job with the minimum amount of resources (efficiency).

FIGURE 11



Merging efficiency and effectiveness is performed with the following technique. On the left hand side of the figure 11 are the results from the efficiency system. The range of scores from Depot #1's 1.179 to #11's .954 is split into 15 equal increments. Each activity's score is placed as it numerically falls within the 15 increments. The same procedure is performed for effectiveness on the right side of the chart. The magnitude of differences between the scores now becomes visible.

Merging efficiency and effectiveness is a straight summation. Depot #1, for example, scores 15 points in efficiency and 8 points in effectiveness for a total of 23 points. The results of the summation are not displayed herein, but are an integral part of quarterly evaluations and analyses.

SUMMARY

The AMC Effectiveness and Efficiency Evaluation System combined a well-established and accepted method of effectiveness review with a method for comparative evaluations of efficiency, to produce a means for measuring total performance of subordinate activities. Still under study or test are expansions into other functions, such as research and development, testing, and other supposedly unmeasurable or hard to measure activities. Incorporation of fixed investment (such as real property and equipment) is also under consideration. The basic approach, or system development, however, is essentially complete; what remains to be done may be regarded as refinement or expansion.

At present the system described in this report is operational. Its results go to the top and intermediate level managers on a quarterly basis and are used in decision making, both for operational control and for resource allocation. In addition, both the outputs and the methodology are employed during the budget process; its effects are also being felt in program planning and in the establishment of program objectives in the Management By Objectives Program.

Perhaps the major single impact of the system to date is motivational. The scoring/ranking results are used by AMC's executive management to spur subordinate managers to achieve needed improvements through competition with similar activities. Commanders in the field have been impelled to create parallel methods for evaluating and (the most important

aspect) for improving their mission accomplishment and productivity.

In only a year's time the results of the system have been significant:

* A total-performance evaluation system was developed and implemented to independently analyze effectiveness and efficiency, and to merge the two sub-systems into one combined evaluation.

* Managers/Commanders became conscious of the other aspect of performance . . . . . efficiency. Efficiency is now an equal partner with effectiveness in managerial decisions.

* The system has promoted improved productivity which has resulted in positive interest and action throughout the command.

* AMC's total efficiency index for the first half of FY 1974 showed more than 3% improvement, and at least a 5% increase is forecast for FY 75. At the same time AMC is showing improvement in effectiveness. Progress is being made in both . . . . .

EFFECTIVENESS AND EFFICIENCY!

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CHAPTER 4

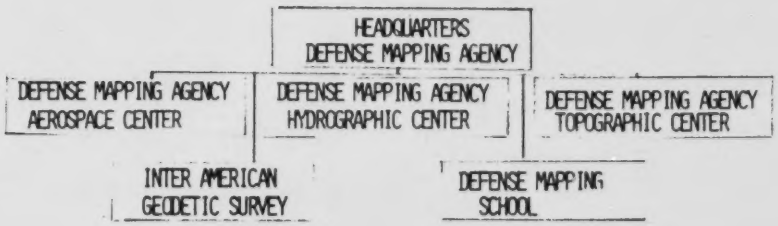
THE EFFECTIVENESS/PRODUCTIVITY PROGRAM IN THE DEFENSE MAPPING AGENCY

BACKGROUND

By Presidential Memorandum on November 5, 1971, the President directed the establishment of a Defense Mapping Agency (DMA) in order to achieve optimum efficiency and economy without impairing the satisfaction of legitimate requirements of the separate Services. The primary mission of DMA is to provide worldwide mapping, charting, and geodetic (MC&G) support for the Department of Defense. The domestic portion of these requirements is primarily met through the U.S. Geological Survey and National Ocean Survey. The DMA became operational on July 1, 1972 and currently operates with an authorized strength of 8,684 (876 military, 7,808 civilian) and an FY 1974 budget of $193 million, including reimbursements.

FIGURE 1

DMA ORGANIZATION AND STAFFING



HQ DMA	195
Defense Mapping School (DMS), Ft. Belvoir, Virginia	200
Hydrographic Center (DMAHC), Suitland, Maryland	973
Aerospace Center (DMAAC), St. Louis, Missouri	3,860
Topographic Center (DMATC), Brookmont, Maryland	3,279
Inter American Geodetic Survey (IAGS), Canal Zone	177
TOTAL DMA STRENGTH	8,684

SOURCE: Defense Mapping Agency

As shown on Figure 1, DMA has three production centers, each oriented toward providing distinctive categories of products and services (aerospace, hydrographic, topographic) and comprising about 94 percent of the DMA manpower. DMA also has a Defense Mapping School, the primary mission of which is to train military personnel in cartography and surveying, and an Inter American Geodetic Survey, the mission of which is to advise and assist Latin American countries in developing and carrying out mapping and surveying programs for their countries.

DMA began operations in July 1972 facing an annual shortfall of $68 million in the resources needed to provide the products and services for which user commands and agencies had a validated requirement over the mid-range (8-year) period. This case study describes actions taken by the new agency to reduce the gap between requirements and resources.

DMA EFFECTIVENESS/PRODUCTIVITY PROGRAM

Rather than seeking a significant increase in program resources, DMA established a two-pronged effort to reduce the gap by: (1) reexamining requirements with DMA's authorized customers to eliminate invalid or marginal needs and (2) performing systematic internal analyses to improve the effectiveness of resource utilization. To focus agency-wide attention, these efforts were designated the DMA Effectiveness/Productivity (E/P) Program. A goal was established to increase productivity by a cumulative 10 percent during the 3-year period, FY 1974-1976. FY 1973, the first year of DMA operations, would serve as the base year and the period in which many of the studies would be made and implemented to achieve the goal.

The program was titled Effectiveness/Productivity in order to emphasize the need for balanced attention to the quality and utility of the support that DMA provides to its customers, as well as to efficiency improvement. In practice, this approach has in some cases caused further study of alternatives and resulted in solutions offering comparable economy and greater effectiveness. The factors associated with increasing effectiveness and productivity at DMA are listed in Figure 2.

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INCREASING EFFECTIVENESS & PRODUCTIVITY

FIGURE 2

EFFECTIVENESS

- HIGHER PRIORITY WORK DONE
- BETTER PRODUCTS
- INVALID NEEDS ELIMINATED
- MORE RESPONSIVE SERVICE

PRODUCTIVITY

- TRANSFER RESOURCES FROM SUPPORT TO PRODUCTION
- IMPROVED TECHNIQUES
- PRODUCTIVITY-ENHANCING EQUIPMENT
- PRODUCT VALUE ENGINEERING
- BETTER MANAGEMENT

The E/P Program has been structured to cause DMA elements to examine every facet of their activities and resources that offers appreciable potential for E/P improvements, and to do so in terms of the level of authority for making a determination of whether to implement improvement proposals. The basic structure of this program, as shown in Figure 3, reflects that approach and is consistent with the decentralized operating authority within DMA.

FIGURE 3

E/P CATEGORY STRUCTURE

I. ITEMS WITHIN COMPONENT DIRECTOR'S AUTHORITY

II. ITEMS REQUIRING DMA DIRECTOR'S APPROVAL

III. ITEMS REQUIRING EXTERNAL COORDINATION

Under Category I, various actions can be taken by a Component Director to reduce support costs and apply the savings to increased production; other actions can increase the efficiency of the existing production resources, such as streamlining product specifications and optimizing equipment use. Major changes in organization and function cutting across DMA Component lines are typical of the kinds of things that are considered under Category II. Category II deals primarily with studies that have a major effect upon the products and services provided by DMA. Changes of this type are coordinated with the principal users of DMA products.

Completed E/P actions must be documented by the originator and validated by the Headquarters. The source and reinvestment disposition of manpower and dollar savings must be recorded and keyed to approved program line items. To be creditable toward the 10 percent E/P goal, the actions must result in identifiable increased production of required MC&G products and services. Under these criteria, theoretical cost avoidance-type actions are screened out and not credited against the E/P goal. Creditable actions make a real and continuing contribution toward reducing the gap between requirements and resources.

As a further means of measuring and recording E/P progress, a DMA productivity measurement system was developed. In its simplest application, the system compares the number of man-hours required to produce a map or chart against the production standard for that product. For example,if the base year standard for production of a Joint Operations Graphic is 1,750 man-hours and subsequent technological improvements permit the product to be produced with an expenditure of 1,675 man-hours, there is a productivity improvement of 4.5 percent. For a comprehensive measure of productivity trends covering all areas of production, the DMA productivity index is a ratio of total product outputs to total operating fund inputs of the three DMA production centers. This comprehensive productivity index rewards efforts to reduce overhead for reapplication to production, as well as efforts to increase efficiency in the production processes.

When DMA was asked to begin participating in the Federal Productivity Project, it was found that the DMA productivity measurement system could support the Federal system with only minor computational adjustments.

EFFECTIVENESS/PRODUCTIVITY RESULTS

Substantial progress is being made toward achieving the 10 percent increase in DMA productivity during the FY 1974-1976 period. This goal is valued at $36 million. Stated in a different way, the DMA goal is to produce an additional $36 million worth of products during FY 1974-1976 without increasing manpower over the FY 1973 level. As of May 1974, benefits valued at $15 million had been validated. Another $17 million worth of benefits have been projected from studies currently underway. Together, these benefits represent 89 percent of the goal.

Some of the most significant benefits have come through organizational changes. Consolidation of the map and chart distribution activities will achieve annual savings of $2.7 million beginning in FY 1975. Realignment of geodetic survey functions freed 44 manpower spaces and nearly $0.5 million per year for other production.

Functional consolidations have also been important. Flight Information Publication responsibilities were consolidated, with net savings of $220,000 in annual funding. Consolidation of DMA payroll functions has brought an annual savings of $50,000 and DMA employees are getting their paychecks 5 days earlier under the new pay system.

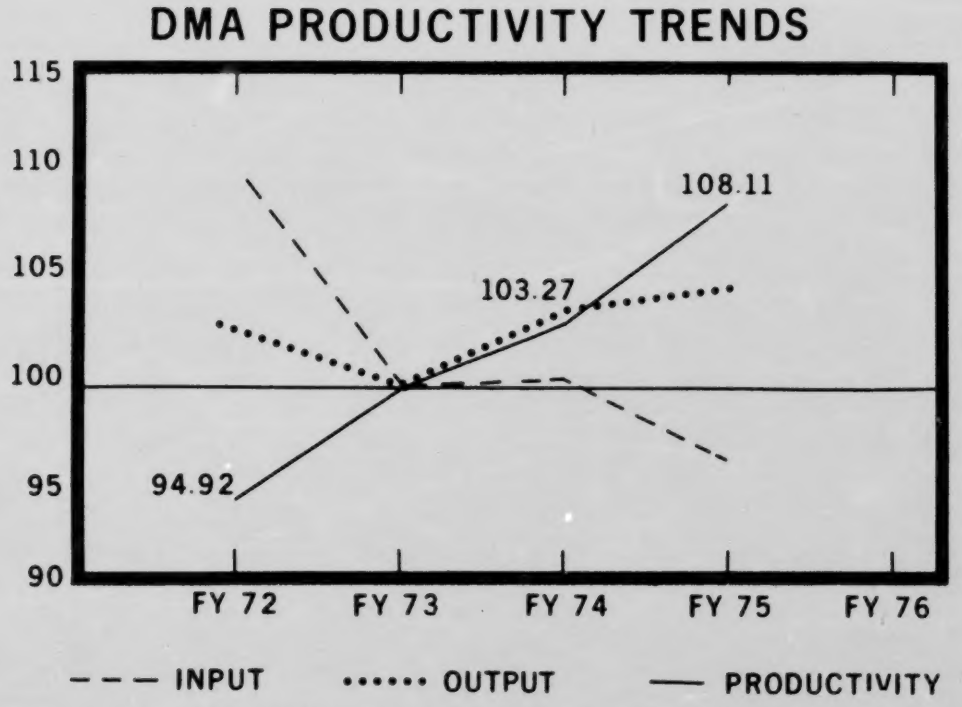
The great bulk of the benefits has resulted from actions taken by the DMA Components within their delegated authorities. Nearly 200 studies have been undertaken by the Components, with benefits ranging from a few thousand to several hundred thousand dollars. For example, an improved procedure for generating orthophotographs from automatic map compilation equipment resulted in both improved products and an annual savings of $44,000. This improvement resulted from an employee suggestion. In another action, an improved pricing structure was established for contract production of Flight Information Publications and resulted in a $150,000 reduction in the annual cost of producing these products. A series of studies on their overhead activities has enabled the Components to free up and reinvest in production areas resources having a total value of nearly $3.5 million over the FY 1974-1976 period.

Although the emphasis of the E/P Program is on achieving a 10 percent productivity improvement during FY 1974-1976,

many of the changes benefitted the FY 1973 program. As a result, data computed under the Federal Productivity Project showed that DMA productivity increased 5.1 percent in FY 1973. An increase of nearly 3.3 percent over FY 1973 was projected for FY 1974 and a further increase of 4.8 percent has been built into the FY 1975 program. Together, the FY 1974 and FY 1975 productivity increases, if achieved, will represent 8.1 of the 10 percent goal for the FY 1974-1976 period.

Trends in the volume of resource inputs, product outputs, and productivity, related to the DMA Base Year of FY 1973, are illustrated in Figure 4.

FIGURE 4



MOTIVATION TO IMPROVE

Although DMA makes considerable use of automation in its production processes, its operations continue to be labor-intensive. Over 80 percent of its annual funding is devoted to the pay of people. Significant improvements in productivity can only be achieved with and through these people. An important aspect of the DMA E/P Program has been to inform its people of the need to improve, to solicit their ideas, and to encourage acceptance of change for the sake of increased effectiveness and productivity.

Various steps have been undertaken to generate and sustain the motivation to improve. The two largest DMA Components developed productivity exhibits designed to explain the E/P goals, to introduce the concepts of productivity enhancement, to show past progress, and to encourage greater effort in the future. Figure 5-7 illustrate portions of one of these exhibits. One of the DMA Components devised for its use an E/P emblem, with the slogan "Working Better Together." The annual DMA Awards Ceremony now includes an award for the Component achieving the greatest E/P savings during the preceding fiscal year. DMA people have responded well. Many of the productivity improvements are coming as a result of employee suggestions.

The measurement and analysis of productivity trends have also been made an integral part of the systems through which DMA manages. The productivity measurement system has been incorporated into the DMA production management system, and the results are an integral part of program reviews. E/P program status is a major topic at the DMA Director's quarterly conferences with his Component Directors and overall progress is reviewed at Headquarters staff meetings.

OUTLOOK

Most of the internal organizational changes and functional consolidations that offered significant productivity benefits have been or are being made. Changing conditions undoubtedly will permit some further improvements later, but the major sources of improvement over the next several years are expected to be procedural changes and technological advances providing for improved production processes and reduced man-hour standards. Concentrated product reviews to streamline

product design and to value engineer existing products are another source of productivity improvements. It is expected that efforts now underway in these areas will enable DMA to reach and perhaps exceed its 10 percent productivity goal in FY 1976.

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FIGURE 5

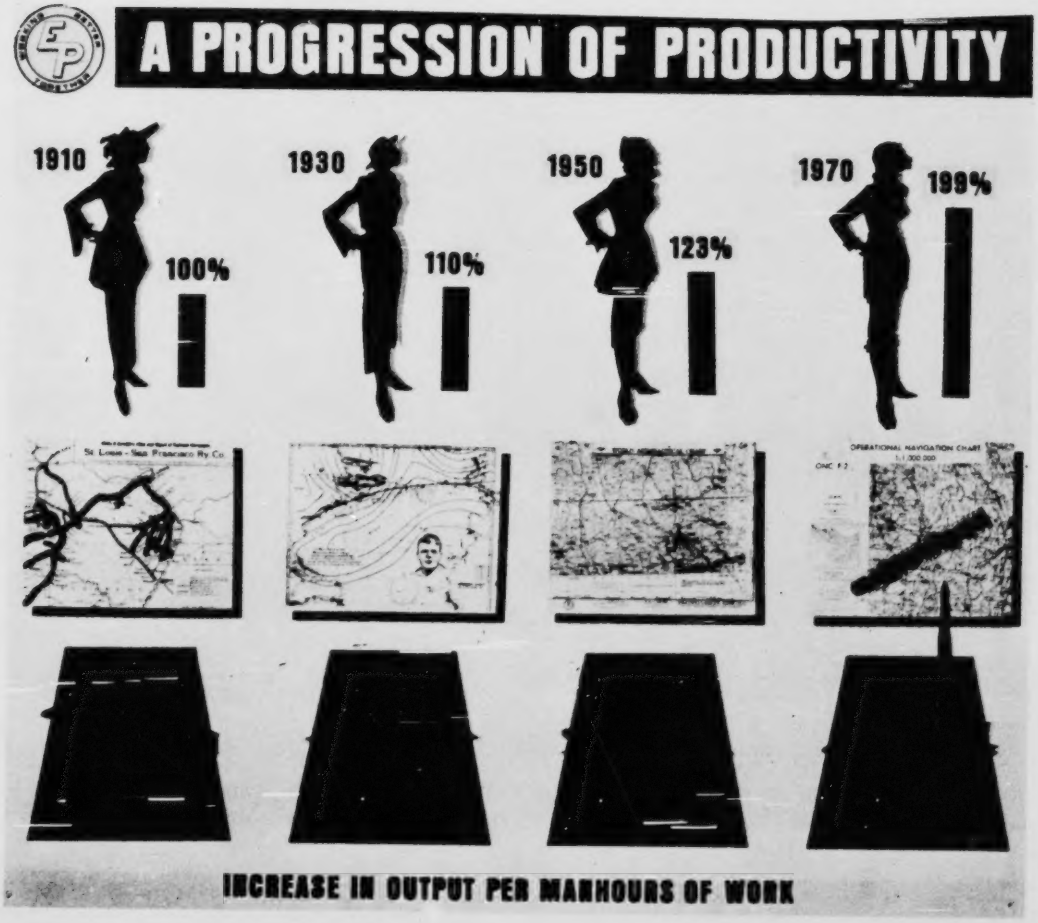

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FIGURE 6

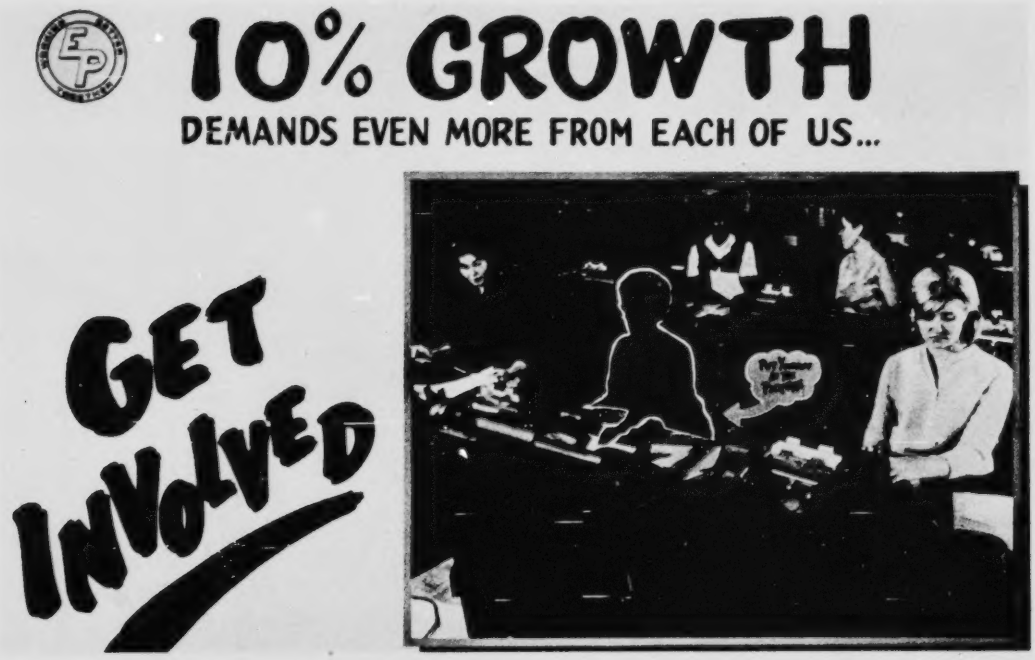
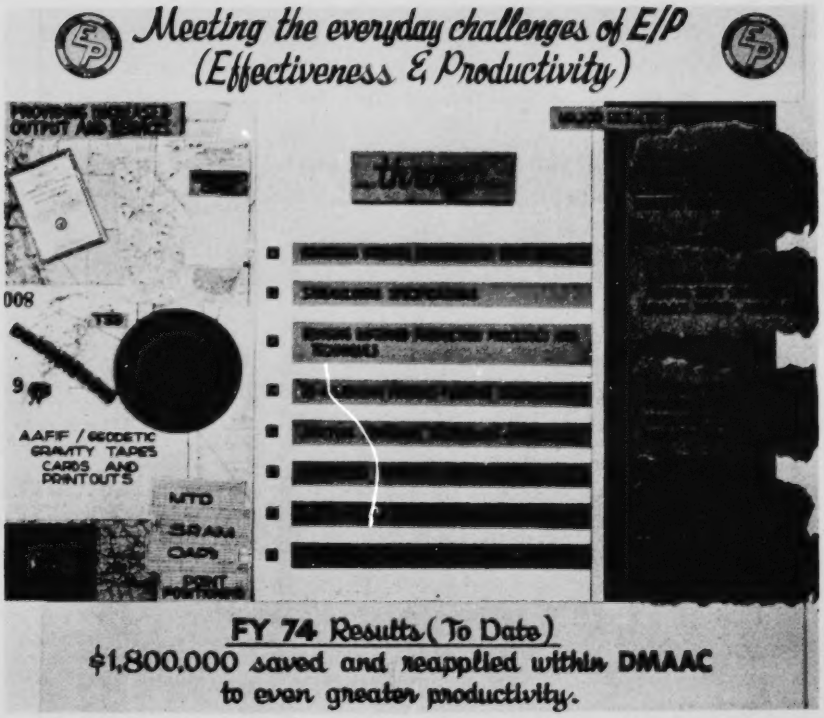


FIGURE 7


Meeting the everyday challenges of E/P
(Effectiveness & Productivity)
AAFF / GEODETIC GRAVITY TAPES CARDS AND PRINTOUTS
MTD
FY 74 Results (To Date)
$1,800,000 saved and reapplied within DMAAC
to even greater productivity.

CHAPTER 5

PRODUCTIVITY MEASUREMENT

IN THE

DEFENSE SUPPLY AGENCY

As a common service organization reporting to the Secretary of Defense, the Defense Supply Agency (DSA) is responsible for providing responsive and economical logistics support in three principal areas:

--World-wide wholesale level supply support for a wide range of consumable materiel and repair parts to the Military Services.

--Contact administration services for a major portion of the purchase actions executed by a centralized buying organization throughout the Defense Department and the National Aeronautics and Space Administration.

--Administration of several Defense-wide logistics services programs, including:

  --Systems for Federal cataloging and providing technical item identification data necessary for Defense-wide logistics operations.

  --Maintenance, storage and reutilization of idle industrial plant equipment.

  --Scientific and technical documentation and information services in support of the Defense research and development community.

  --World-wide reporting, utilization and disposition of excess and surplus personal property.

The initial establishment of DSA as a common support element within the Defense Department in 1961 was, in itself, an improvement action designed to bring about productivity increases in the assigned areas. The Agency was formed

SOURCE: Defense Supply Agency

through the consolidation of various supply and services elements previously operating within the separate Military Services. From its very beginning, its primary objectives have been:

--To insure effective and timely support of the operating forces in war and peace; and

--To furnish this support at the lowest practicable cost.

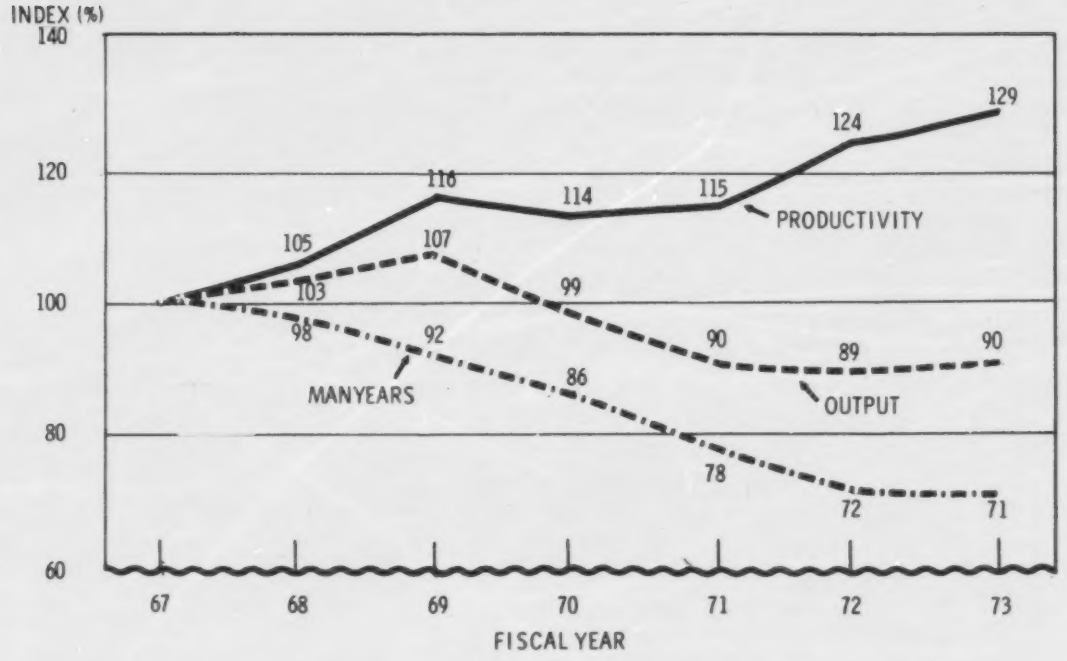
DSA PRODUCTIVITY

Since the activation of DSA, constant management attention to the basic goal of maximum efficiency has produced significant operating economies. In the early years of DSA, 1962-1966, increased productivity was realized through manpower reductions as numerous organizational and procedural improvements were effected. However, it was not until FY 1967 that a formal output and productivity evaluation system was installed. Since that time, overall output per man-year has increased almost 30 percent.

Chart 1 depicts the composite productivity trend for the agency from FY 1967 through FY 1973. The index shown was derived from the basic data which constituted DSA's input to the Government-wide productivity project. Improvement has averaged about 5 percent per year for the past six years. DSA currently employs about 52,000 military and civilian personnel in performing its assigned mission. Had the increase in productivity reflected on this chart not been realized, today's job would require about 10,000 more personnel than are currently employed.

CHART 1

DSA COMPOSITE PRODUCTIVITY TREND
(FY 1967 = 100%)

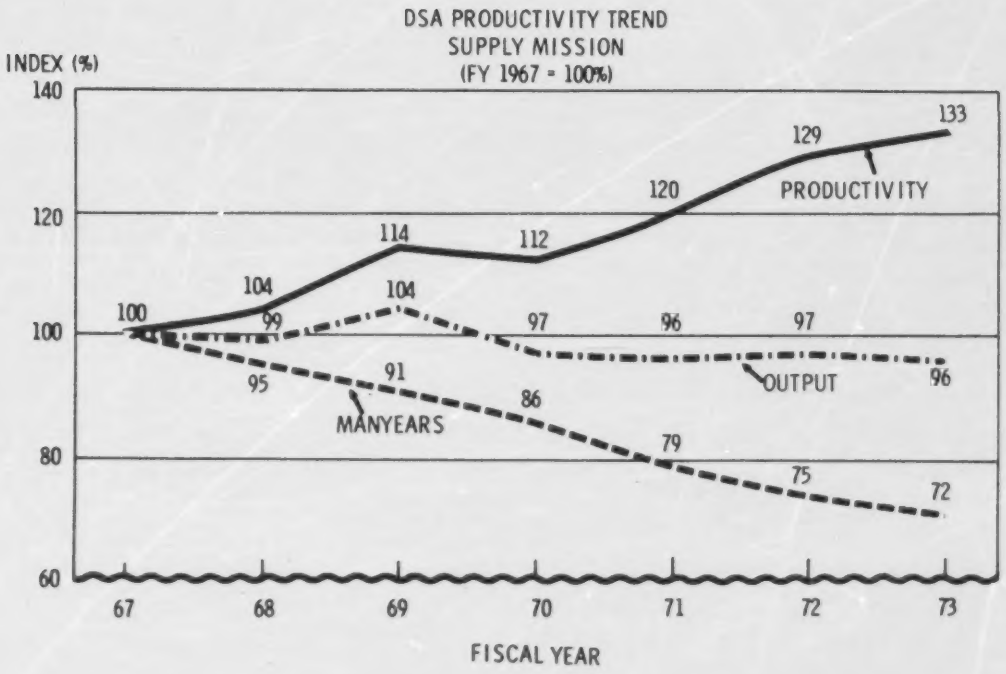


The significant long-term improvement reflected on this overview chart is a composite of individual trends in each of the several mission programs. This general improvement resulted from a combination of organizational realignments, systems improvements through automation and mechanization, and a host of methods and procedures refinements generated by aggressive management engineering efforts. A closer look at comparable charts for selected program areas which are included in this composite will serve to demonstrate these achievements. It will also permit the highlighting of certain considerations which could become pitfalls in the interpretation of gross trend data of this kind.

SUPPORT SUPPLY

Chart 2 depicts the long-term trend for those functional programs which comprise the basic supply mission of the Agency. These functional areas include procurement, materiel management, technical and logistics services and supply depot operations. The trend here is generally consistent with the larger composite, although somewhat greater gains are reflected over the total period.

CHART 2



The general improvement trend was temporarily interrupted in FY 1970 due to the drop in workload reflected by the output index. DSA's prime mission requires effective response to the support needs generated by its military services customers. The Agency does not control these requirements, nor consequently the workloads they generate. Workload forecasting is especially important--and difficult--under these conditions. DSA's management system provides for the development of such forecasts and the tracking of actual operations to detect significant variations from plan. However, while the system permitted expeditious action, the rate of decline experienced in FY 1970 exceeded DSA's capability to effect commensurate manpower adjustments under existing personnel management processes.

The workload and productivity decline noted in FY 1970 would have been greater had there not been changes in the basic work mix which took place at the same time. Specifically, in the procurement program there were increases in the proportion of awards completed utilizing small purchase procedures, which required fewer manhours per unit to process. In supply depot operations, there was a reduction in the size of the average shipment which, together with the

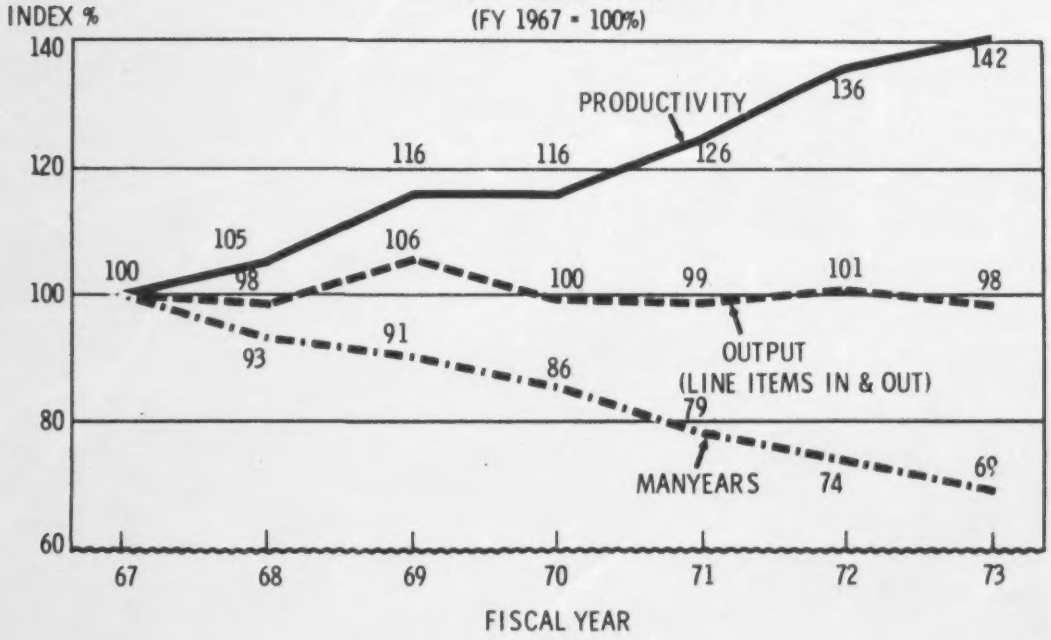
progressive mechanization of warehousing operations, permitted a reduction in manpower applied to process each transaction.

The reduction in the average depot shipment size reflected a change in Military Service demand patterns which resulted in the submission to DSA of requisitions for lesser quantities and dollar value.

Chart 3 addresses the productivity trend for the depot operations segment of the supply mission. It demonstrates further the impact of work mix and systems improvements actions on the productivity trend in the area.

CHART 3

DSA PRODUCTIVITY TREND
DEPOT OPERATIONS
(FY 1967 = 100%)



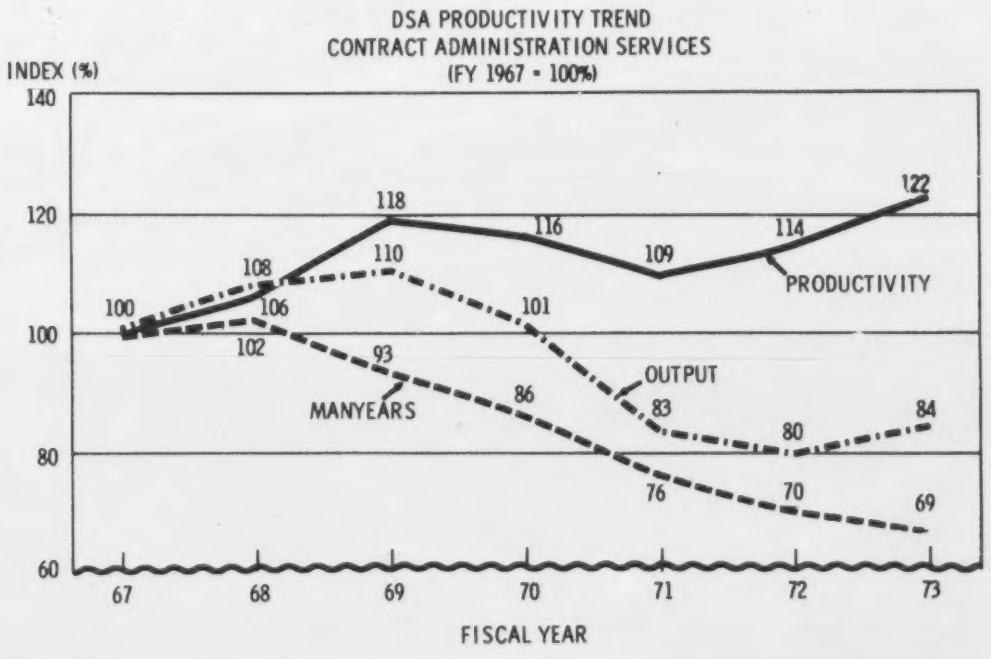
While the data shown on this chart reflects a general parallel trend to that noted earlier, there are some noteworthy differences. For example, the decline in productivity from FY 1969 to FY 1970, noted on the preceding chart, is not reflected here. In this area, manpower reductions were effected through extensive automation and mechanization of

warehousing and shipping procedures and operations. These savings compensated for the decline in workload which occurred. The mechanization actions effected also made a substantial contribution to the acceleration of productivity growth depicted during the FY 1970-72 time frame. The pay-off from these actions has been a recurring savings of about 450 manyears in labor input.

CONTRACT ADMINISTRATION

Chart 4 portrays the overall trend for the several subordinate functions which comprise this mission. These include Production Surveillance, Contract Administration, Quality Assurance and Contract Payment operations.

CHART 4



In this area the improvement trend does not reflect either the consistency or the degree of improvement which characterized the earlier chart for the supply mission. Comparable workload declines to those which occurred in the supply mission area in the FY 1969-70 period also occurred

here. However, the decline in the instant case extended through FY 1971 at a more pronounced rate. Again, the rate of decline precluded commensurate adjustments to the manpower applied.

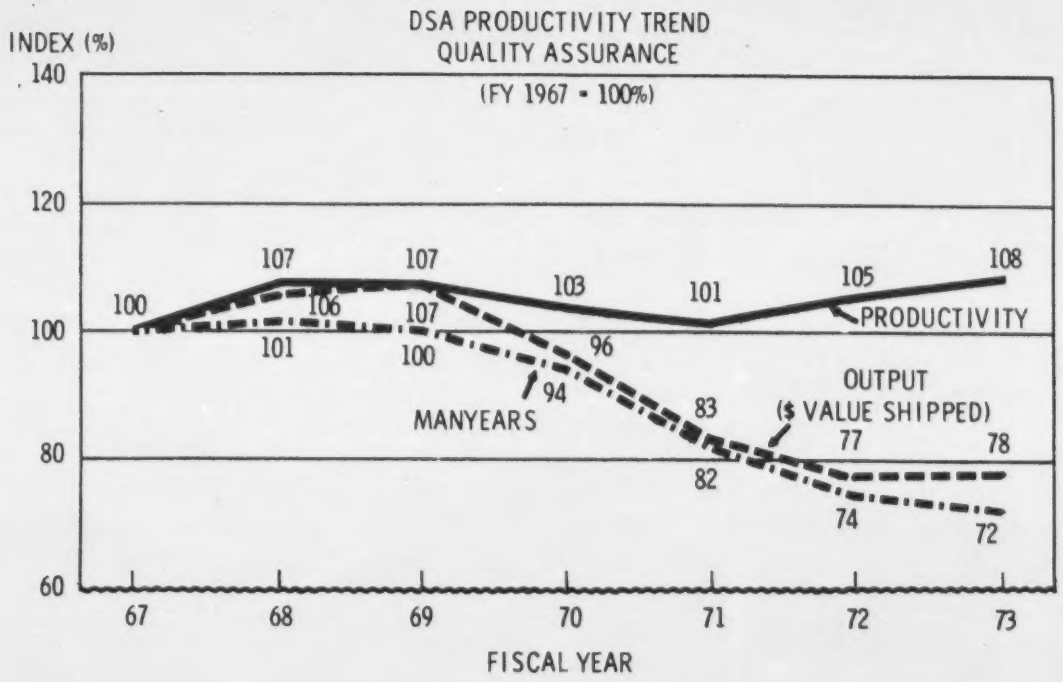
Gross productivity in the Contract Administration Services mission has been impacted since FY 1971 by changes in the complexity and scope of the input required to process a given unit of output, or to maintain acceptable quality standards. Detailed analysis of the underlying data indicates that changes of this kind have exerted a dampening effect on the overall productivity trend, although that trend has continued to reflect improvement. A contract administered and a dollar shipped mean something different today. In practical effect, productivity gains have been partially offset by increases in the scope and complexity of effort involved.

The development of valid output measures which can consistently reflect changes in the quality or scope of any of the Contract Administration Services functions has proven to be a major challenge. This is especially true in the case of quality assurance operations.

LOGISTICS SERVICES

The productivity trend for quality assurance operations as seen on Chart 5 is much less pronounced than those discussed earlier. Output for this program is measured in terms of the value of material inspected and released for shipments. To correct operational deficiencies and improve the quality of the material and supplies being delivered to the military services supply systems, a special quality improvement program has recently been implemented. While this program is designed to improve the quality of the product delivered to the customer, it requires additional manpower for performing the more extensive product inspection required in processing a given shipment. The additional effort applied depresses the resultant productivity since it is not reflected in a comparable increase in the final output units. The development of an improved measurement technique in this area is being studied.

CHART 5



The Quality Assurance function exhibits a further characteristic which makes the timely adjustments of manpower commensurate with workload fluctuations especially difficult. Personnel engaged in this program are located at widely dispersed geographic locations. A high degree of specialization is also required of this segment of the work force. These factors frequently preclude manpower reductions to the same degree that the workload at any given location might be reduced. Corrective action in these situations could require an extended period of time to effect. This highlights a potential pitfall which could be encountered if ongoing decisions place undue emphasis on short-term qualitative assessments.

THE INTEGRATED MEASUREMENT SYSTEM

Despite the limitations and potential difficulties in the interpretation of gross productivity data, DSA has been able to utilize composite productivity measures to distinct advantage. Summary productivity measurements of this

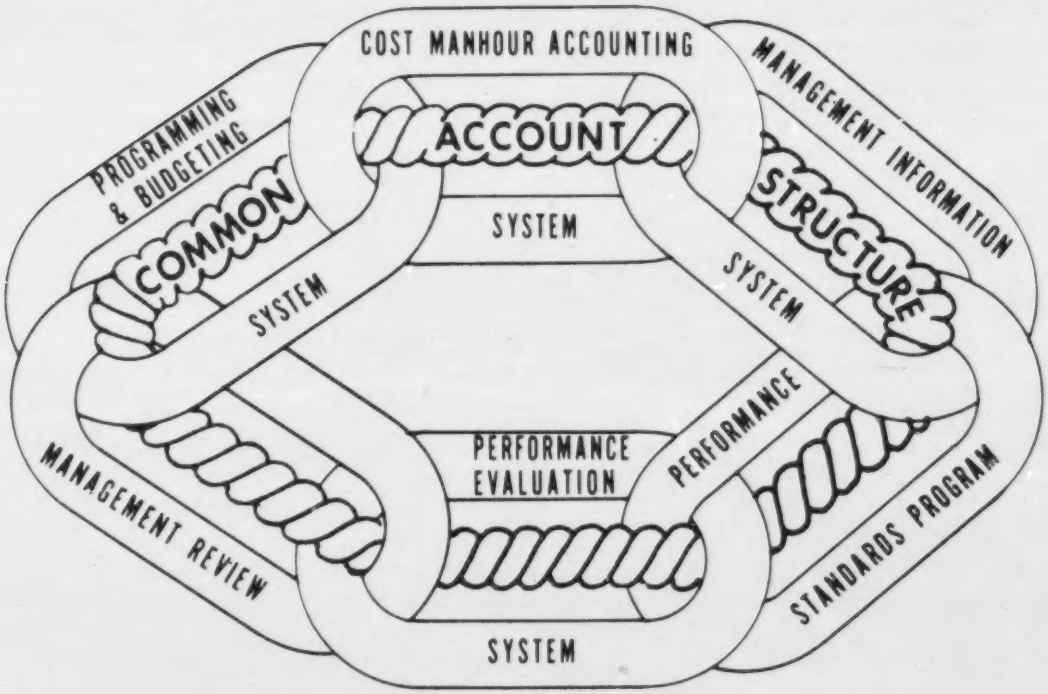
type serve to depict the net effect of the host of individual management improvement actions which are continuously taking place. In addition, they demonstrate the effectiveness with which ongoing management control systems are functioning in achieving efficiency improvements. DSA has recently applied these techniques in connection with a comprehensive review of the Agency's current and anticipated manpower requirements, in demonstrating to higher authority the significant productivity acheivements which have already been realized through its ongoing resources management processes.

The information which constitutes DSA's input to the Federal productivity improvement project has been generated through a comprehensive resources management system implemented and refined by the Agency over the past several years. This system incorporates performance standards and productivity measurement techniques as integral elements. This "total" system undergirds DSA's continuing efforts to "do more with less" through productivity improvement.

Chart 6 depicts the basic elements of the DSA Integrated Resources Management System. It is a fully coordinated system in which the component elements, seen as the links in a continuous chain, are interfaced to complement each other. The system provides the frame work for projecting and tracking workload trends, determining resource requirements through the application of performance standards, and continuously evaluating operating results.

CHART 6

DSA INTEGRATED RESOURCES MANAGEMENT



Starting with the top link in the chain, and proceeding clockwise, the principal elements of the DSA Integrated Resources Management System are:

--A Cost Accounting System which provides for the accumulation of basic resources consumption data.

--A Management Information System which is the prime medium for the reporting of operating results to the Agency Headquarters.

--A Performance Standard Program which established performance standards used in evaluating productive efficiency.

--A Performance Evaluation Report System, an automated analytical technique which continuously appraises operating performance, with primary emphasis on the relationship between workload performed and resources consumed.

--A Management Review System for comprehensive performance appraisal briefings to top management on a regularly scheduled basis. This forms a basis for initiating early corrective actions, procedural refinements, and policy reviews.

--A Programming/Budgeting System which translated workload forecasts, productivity rates and unit costs into manpower and financial resources requirements. This is the link which gives pay-off effect to all of the others. Through the common account structure which is basic to the total System, a high degree of precision and uniformity is realized in DSA's resources determination and allocation processes. DSA's performance-based budgeting also provides a solid basis for resources justification to the OMB and the Congress.

Chart 7 depicts one element of the total resources management system which plays a particularly vital role in the DSA output and productivity measurement efforts. This is the automated information system which collects data on operating results from DSA's field activities monthly. It incorporates a central bank of manpower, cost and performance data which permits managers at both the field and Headquarters levels to communicate in common terms and to work from the same performance and productivity data base. Chart 7 displays the key data elements which this system provides. Those listed on the left are included for all mission program areas. Other data elements, such as those listed on the right, are tailored to specific mission areas--in this example, supply operations. The data provided by the Management Information System are fundamental to performance budgeting and evaluation at all organizational levels.

CHART 7

DSA MANAGEMENT INFORMATION SYSTEM
KEY DATA ELEMENTS

COMMON TO ALL MISSIONS:

- WORKLOAD
  - PROGRAMMED
  - ACCOMPLISHED
  - ON HAND
- MANHOURS APPLIED
- OUTPUT UNIT COSTS

SPECIFIC MISSION: (SUPPLY OPERATIONS)

- QUANTITATIVE
  - PROCUREMENT AWARDS
  - REQUISITIONS PROCESSED
  - DEPOT RECEIPTS/ISSUES
- QUALITATIVE
  - SUPPLY AVAILABILITY
  - BACKORDERS
  - ON-TIME SHIPMENT
  - WAREHOUSE DENIALS
  - PROCUREMENT LEADTIME

In the case of the specific program area data elements, two types of indicators are listed. The quantitative elements provide information on workload volumes in terms of selected, mission-oriented output measures. Equally important, but frequently overlooked, are the qualitative measures which reflect program effectiveness with regard to the degree of responsiveness and customer satisfaction. The DSA system provides for both evaluations of efficiency in the application of resources and operational effectiveness as complementing appraisals. Both quantitative output and qualitative effectiveness data are reviewed on a regular recurring basis in comprehensive performance appraisals which are integral to DSA's internal management review process. This procedure assures that quantitative considerations are not overemphasized to the deteriment of quality factors.

Accurate and reliable data are, of course, essential to valid management decisions. DSA, has established accounting disciplines, including internal audits, to validate reported

data at the source. Also, heavy reliance is placed on automated data systems to generate the basic input directly into the reporting system. This minimizes the introduction of errors created through human intervention.

DSA's resources management system was designed initially as a means of effectively monitoring short-term fluctuations in the workload/work force relationship to assure utmost efficiency in the allocation of available resources. It also provided a basis for the determination and justification of requirements for near-term operations. However, because it incorporates measures of organizational outputs and resources consumption required for appraising productivity trends over long time periods, the System also provides a basis for the development of composite productivity measurements relative to a fixed base period.

The need for such summary productivity indexes to assess the net impact of all of the individual short-term management control actions continuously being taken was recognized in the DSA just prior to the time that the Government-wide productivity measurement effort was initiated in 1971. The internal actions which were already underway, especially in the area of refined output measurement techniques, generated much of the basic data that became DSA's input to the joint project.

In DSA's experience, there are certain potential risks which must be considered in using composite productivity indexes. These include:

--Drawing invalid inferences from the absolute values associated with gross output measures.

--Overreacting to short-term changes, especially when an adverse trend is indicated.

--Overemphasizing quantitative measures to the detriment of quality considerations.

In a highly summarized composite measure, these risks could become significant and should not be overlooked.

In discussing actual productivity trends in DSA's quality assurance operations, it should be noted that valid

output measures are the essential ingredients of any productivity measurement system. These measures are especially critical in a system based on high-order composites of a highly diversified operation. Changes in the complexity and scope of the efforts (or input) required to produce a given output, or to maintain acceptable quality standards, can easily become submerged and be overlooked when highly summarized measures are employed. While progress has been made, DSA continues to aggressively seek improved output measures which will further enhance the utility of its productivity measurement systems.

Present productivity measurement systems are limited in scope largely to evaluations of manpower efficiency. These systems do not provide, except indirectly, for an assessment of total productivity which reflects the effectiveness with which capital is substituted for labor. DSA has underway a long-term effort leading to the establishment of a productivity measurement technique which integrates manpower and costs into a single index.

THE HUMAN SIDE

DSA has a reputation and is known by its people as a concerned employer. The vocational aspirations of DSA people--the key to success in achieving improved productivity--are of paramount concern. Accordingly, the agency is actively involved in a project undertaken to assess the behavioral aspects of productivity measurement systems. This project, being administered through the National Academy for Public Administration, seeks to increase productivity through more effective use of human resources. Motivational research involving about 4,500 employees is currently underway at two of DSA's major field activities.

As the techniques of measurement are progressively refined, DSA looks to even greater use of productivity measures in manpower and budget planning at the higher management levels. In this regard, DSA is cooperating in research to devise effective means for refining "raw" productivity measures to reflect changes in performance quality. Such refinement is necessary, so that quality considerations can enter more extensively into the budget formulation process.

DSA management fully recognizes the potential for a productivity measurement system and will continue to expand the use of such measures in its operations. DSA management supports the Government-wide productivity effort as a means of achieving increased output per man-year in the Federal sector.

CHAPTER 6

TECHNOLOGY REPAIR CENTERS

IN THE AIR FORCE

INTRODUCTION

The U.S. Air Force consists today of a fleet of 10,000 aircraft with its supporting weapons and components. To maintain and overhaul these systems, the Air Force operates a network of large supply-maintenance installations known as Air Logistic Centers (ALC). There are five of these major centers as follows:

AIR LOGISTIC CENTERS

Name	Major Depot Maintenance Mission
Oklahoma City	B-52G (Bomber), engine overhaul engine components, pneumatic accessories
Ogden	F-4 (Fighter), missilies, landing gear, navigational instruments
San Antonio	C-5 (Jumbo Cargo), engine overhaul and components, electronic AGE components
Sacramento	F-111 (Fighter/Bomber), ground C-E-M, flight control accessories, hydraulics
Warner Robins	C-141 (Cargo), airborne electronic components, gyros

Average civilian manyears in FY 1973 for the 5 ALCs totaled 44,131 with expenditures of $838 million.

In response to DOD-wide economy pressures and reducing workloads, the Air Force Logistics Command (AFLC) has implemented a new concept of depot repair.

Studies by AFLC revealed that past policies in the assignment of technical mission responsibilities among the

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SOURCE: Air Force Logistics Command

five ALCs (which has been primarily on the basis of specific aircraft and weapon systems) resulted in the duplication of manpower skill, technology, and equipment among the ALCs, in a large number of cases.

By realigning these assignements, so as to obtain centralization of skills, technology, and equipment rather than aligning on the basis of weapon system applications and/or Federal supply class categories, it has been found that significant gains in productivity through labor savings will occur. As a result, specialized entities known as Technology Repair Centers (TRCs), are being established, beginning in January 1974 and phased over a period of approximately 2 years.

This concept consolidates the repair of aeronautical hardware that requires like skills, facilities, tools and test equipment. This will provide for the optimum cost arrangement of skills, equipment and facilities and provide maximum discrimination of assignment possibilities. The specific improvements which have been generated by the realignment are as follows:

(a) Minimize Redundancy: AFLC had 52 repair points for 18 basic technologies involved in the exhangeables business, an average of almost three ALC repair points per technology. Upon completion of the TRC alignment, AFLC will reduce operating repair points from 52 down to 23 locations, or an average of slightly more than one repair point for each of the 18 basic technologies. Thus, consolidating action will enhance the ratio of homogeneous workload volume per repair point from a current level of 284,000 direct man-hours per location to 644,000 direct man-hours per location on an annual basis.

(b) Reduce Organizational Structure: AFLC has 27 product divisions within the five ALCs employing some 41,000 people in depot maintenance. Upon completion of the TRC workload consolidation, AFLC will require 21 product divisions to carry out the mission. The homogeneous grouping of workload will allow the elimination of two accessories divisions, three electronics divisions, five precision measurement equipment divisions, and five manufacturing and repair divisions and the addition of one gyro

division, three instrument divisions and five commodity divisions.

(c) Reduce Overhead Management: AFLC had assigned approximately 11,000 personnel within the Directorate of Maintenance involved in the overhead management of depot maintenance. By reducing the number of multiple repair points engaged in each technology workload group, and in turn, the number of product divisions required, a reduction in overhead management required will be achieved. It is expected that the Directorates of Maintenance will reduce overhead collectively by approximately 1,100 manpower spaces. O&M support to maintenance will also be reduced by approximately 50 manyears of support as a result of the consolidation. These reductions are considered to represent hard savings that can be realized on a recurring annual basis after the TRC plan is fully implemented, as shown below:

REDUCED OVERHEAD MANPOWER

	1st Year	2nd Year
Manpower Spaces Withdrawn	597	556
Manyear Dollar Savings (Cumulative in Millions)	$5.7	$16.7

(d) Reduce Excess Facilities: One of the major pressures of recent DOD policy is to eliminate excess industrial capacity that cannot be justified on either a peace or wartime workload basis. The TRC plan was designed to consolidate the need for multiple facilities in each technology area. As a result, the AFLC depot structure will "reduce" by appromimately 2 million square feet of covered facilities. This drawdown will occur by eliminating maintenance operations from some 200 separate buildings out of a total of more than 500 maintenance structures across the five ALCs. Buildings vacated will be razed if beyond econmic upgrading or converted to other functional mission areas if worthy of retention.

(e) Increase Plant Utilization: Current DOD policy requires that the services plan to achieve 85 percent

utilization of industrial maintenance facilities on a one-shift, 40-hour workweek during peacetime. By consolidating similar workloads into fewer repair locations and reducing the overall output capacity of AFLC facilities, utilization will increase from 67 percent to approximately 83 percent at the completion of the reposture plan currently estimated for the 1976 time period.

(f) Mission and Mobilization Balance: A continuing objective within the Air Force is to develop and retain an industrial base which is sized to be cost-effective in peacetime and also capable of assured surge in a limited time frame during periods of mobilization. The question of balanced workload distribution in proportion to capacity during peacetime becomes essential in attaining the time sensitive rate of buildup required to support combat operations. Today the Air Force has a high of 28 percent of its mobilization related workload assigned to one depot and a low of 12 percent assigned to another depot. In the post-TRC time period, the mobilization related workload base will be distributed in a more balanced manner varying from a high of 23 percent to a low of 17 percent. Greater assurance of rapid reaction capability will be provided by aligning toward a more proportionate mission assignment at each ALC for support of the Air Force's highest priority mission essential programs.

The overall program of implementing the TRC concept involves expenditures of approximately $26 million over a period of 24 months. However, approximately 2 years after completion of the realignment, the full cost will have been paid back and annual recurring savings estimated at $17.8 million will occur thereafter.

Fifty-two percent of the number of line items to be realigned will have been completed by September 1974. This represents 50 percent of the workload in manhours being realigned.

CHAPTER 7

BUDGET USE OF PRODUCTIVITY MEASURES IN THE NATIONAL LABOR RELATIONS BOARD

BACKGROUND

This case study (1) describes the evolution and establishment of a program for the measurement of professional employee productivity in the National Labor Relations Board field offices; (2) briefly surveys productivity measurement systems in other areas of case processing within the Agency; and (3) reports on management's use of the information.

Congress has enacted and has regularly amended the National Labor Relations Act. This Act is the Nation's principal labor relations law for the purpose of reducing industrial strife by defining and protecting the legitimate rights of participants in labor disputes. The Amendments, the expansion of jurisdiction under other public laws, and the growth of the Nation have combined to steadily increase the NLRB workload.

The National Labor Relations Act states and defines the right of employees to organize and to bargain collectively with their employers through representatives of their own choosing. Congress has designated certain practices of employers and unions as unfair labor practices in order to protect the rights of employees and employers, and to prevent labor disputes that would adversely affect the rights of the public. The NLRB, an independent Federal Agency, is charged by the Act with the responsibility for administering this law.

The NLRB consists of a five-member Board and a General Counsel. The General Counsel and his staff, through 31 Regional Offices and other field offices located in major cities in various sections of the country, investigate and prosecute unfair labor practice cases and conduct elections to determine employee representatives. The five-member Board decides cases involving charges of unfair labor practices and petitions to determine representation election questions that come to it from Regional Offices.

SOURCE: National Labor Relations Board

The Agency proceeds, and its workload begins, when charges and petitions are filed by employers, individuals, and unions. It is important to note that the Agency cannot initiate cases on its own motion, and thereby control its caseload.

As a matter of policy, the Agency strives for the voluntary settlement of disputes at all stages of case processing, particularly before formal consideration by the Board, the General Counsel or the courts. Currently about 93.1 percent of the unfair labor practice cases and about 82.1 percent of the representation cases are closed by agreement, dismissal, or withdrawal, and only 5 percent of the unfair labor practice cases and 17.7 percent of the representation cases require formal hearing and decision.

NEED FOR PRODUCTIVITY EVALUATION

The emergence of the United States into the post-World War II economy of 1947 intensified demands on Agency resources. Coupled with this was the passage on August 22, 1947, of the Labor Management Relations Act of 1947 (Taft-Hartley Act), amending the original Wagner Act and greatly expanding the numbers and types of cases the Agency could be called upon to process.

Originally there were but two types of cases. Manpower justifications were comparatively simple. However, past practices could not be applied to the types of cases added with the Taft-Hartley Act.

PRODUCTIVITY MEASUREMENT SYSTEMS IN FIELD OFFICES

In 1949 the NLRB's Budget Branch conducted a time distribution study for all professional employees in the field. The purpose was to find an objective basis upon which to project budget estimates. All professional employees were asked to indicate how much time was spent by type of case and by type of disposition associated with different stages of field case work. Attorneys' and field examiners' time data was accumulated for a period of 4 months. The time reports were daily. A national performance average of professional time allocable to case disposition by type of professional employee was subsequently developed for the budgeting process. For the first time, extensions and projections could be made to provide an accurate and realistic means of calculating

both field examiner and field attorney manpower needs. Since then the system has been refined and improved.

The following table illustrates the method currently used for calculating professional manpower requirements for production activities of the field offices. Based on past experience, projections are made of the members of different types of cases and the manner in which they are expected to be handled. After professional requirements have been determined in this manner, estimates for overhead and clerical staff are added to obtain total field office manpower requirements.

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EXHIBIT 1

DIVISION OF OPERATIONS - FIELD STAFF

Analysis of Production Rate and Man-Year Requirements

	Past Year - Actual			Current Year - Estimate			Budget Year - Estimate		
	Number	Rate per Man-Year	Employ. Required	Number	Rate per Man-Year	Employ. Required	Number	Rate per Man-Year	Employ. Required
TYPES									
Charge Against Employer Work									
Before Complaint:									
Withdrawal	6,005	83.8	71.7	6,475	91.6	70.7	6,863	93.4	73.5
Dismissal	5,985	55.8	108.2	6,436	60.5	160.4	6,822	61.7	110.6
Settlement	3,135	41.4	75.7	3,372	45.4	74.3	3,574	46.3	77.2
Complaints Disposed	(2,197)	(11.9)	(184.6)	(2,370)	(12.9)	(184.2)	(2,512)	(13.1)	(191.6)
After Complaint:									
Adjusted	1,220	13.2	92.4	1,252	14.4	87.0	1,327	14.7	90.3
Hearings	977	10.6	92.2	1,118	11.5	97.2	1,185	11.7	101.3
Total charge against employer work - Proceedings	17,322	(39.4)	440.2	18,653	(42.8)	489.6	19,771	(43.7)	452.9
Cases	17,893			19,270			20,425		
Charge Against Labor Organization Work									
Before Complaint:									
Withdrawal	2,280	144.5	15.8	2,560	158.1	16.2	2,715	161.3	16.8
Dismissal	2,379	125.9	18.9	2,668	137.8	19.4	2,829	140.6	20.1
Settlement	727	108.0	6.7	813	118.1	6.9	862	120.5	7.2
Complaints Disposed	(229)	(16.3)	(16.3)	(336)	(19.9)	(16.9)	(356)	(20.3)	(17.5)
After Complaint:									
Adjusted	162	23.4	6.9	181	25.6	7.1	192	26.1	7.4
Hearings	137	14.5	9.4	155	15.9	9.8	164	16.2	10.1
Total Charge against labor organizations - Proceedings	5,685	(98.5)	57.7	6,377	(107.4)	59.4	6,762	(109.8)	61.6
Cases	5,989			6,720			7,125		

OTHER PRODUCTIVITY MEASUREMENT SYSTEMS

The Office of Appeals handles appeals from Regional Directors' refusals to issue complaints (field dismissals). All dismissals are not appealed, but the Appeals case intake is based on the number of dismissals in the Regional Offices. The percentage of appeals resulting from the dismissals in the actual year is applied to the estimated dismissals in the budgeted year. The expected number of appeals divided by the analyzed individual attorneys' productivity rate yields the man-years needed to handle the expected caseload. This employment, weighted for overhead staff and a proportionate clerical staff, furnishes a figure for the staff needed to handle the Appeals workload.

The Division of Advice handles all cases that are sent to the General Counsel from the field offices for his advice on how to dispose of the cases. Advice work is based on the percentage of advice requests to the total cases closed in the actual year. The percentage is applied to the estimated Regional Office dispositions in the budgeted year to yield the total estimated requests for advice. This figure, in turn divided by the analyzed productivity rate, gives the employment required to process the estimated Advice cases. Again, weighted overhead and a proportionate clerical staff are added.

The Appellate Court Branch is responsible for securing enforcement of Board Orders in the circuit courts of appeals. The case intake is the percentage of Board decisions requiring enforcement by the courts. Briefs to the courts constitute the main units of output. The number of briefs estimated for a budget year will be equal to the proportion of briefs filed in the past actual year to the total number of cases referred for enforcement. This ratio applied to, i.e. divided by, the productivity rate gives man-year requirements for Appellate Court production. Clerical and overhead weights are added to derive the final total estimated manpower need.

In the Administrative Law Judge Division, the Administrative Law Judges hear all unfair labor practice cases in which a Regional Director has issued a complaint. Emphasis is put on settlement at every stage prior to decision. Cases intake to the Judges Division is based upon the

Regional Office cases that result in complaints. Case dispositions by Administrative Law Judges are credited for productivity analysis according to their participation in each type. Judge manpower is then forecast on the basis of estimated case requirements with an added allowance for special assignments. This employment, plus the customary weighting for clerical and administrative support, provides an estimate of the staff needed to deal with the expected caseload.

The workload for the Board staff is based on the number of unfair labor practice cases expected to be appealed for Board decisions. In representation-type cases handled by the Regional Directors, appeals also go to the Board and, therefore, are included in the Board's estimated workload. Productivity rates for legal assistants to the Board Members are determined by projecting actual case production in the past experience year. The productivity rate when divided into the total expected intake of appeals from both Regional Directors and Administrative Law Judges determines the man-years required for the budget year program.

MANAGEMENT EVALUATION AND USE

In developing an annual budget, the Agency statistically forecasts employment needs for each case-processing area in the Agency, which are combined with qualitative adjustments to define, and meet, the Agency's objectives. The Agency seeks to reduce labor strife by maximizing voluntary settlement of charges and petitions found, after investigation, to warrant further processing. The Agency also strives to reduce to the absolute minimum, consistent with fair process, the time required to process a case not closed by settlement, i.e. those which must be litigated.

To formulate each budget, therefore, the base year's case-processing experience at each case stage is examined and needs are estimated in the light of the objectives to be met in the budget year. If case processing has not been current at any stage, for example, provision must be made to achieve current processing status by allocating additional manpower or by making changes designed to improve efficiency. In the NLRB all case-processing areas are expected to improve each year. Improvement in rates has ranged as high as 20 percent from year to year. During the execution phase of the budget there is follow-up to see if plans are being

met. If further effort or a change in plan is necessary, reprogramming is scheduled.

The manner in which Board Members, the General Counsel, Regional Directors, Division Chiefs, and other Agency administrators use budget productivity and case-processing data in long-range planning and day-to-day administration is illustrated by looking at the General Counsel--Field functions.

In 1959, using budget processing data, the General Counsel set up a Time and Performance Branch which measured and monitored case-handling efficiency in the field. Today this function is combined with daily executive direction in the Division of Operations Management.

Implemental procedures and statistics have been enhanced by management expertise. Currently, statistics are routinely gathered on such performance as the percentage of cases successfully litigated and settled, the median age of cases pending under investigation, the median days to issuance of complaint, the number and percentage of overage cases in process, etc. (See Exhibit 2 and 3. below.)

EXHIBIT 2

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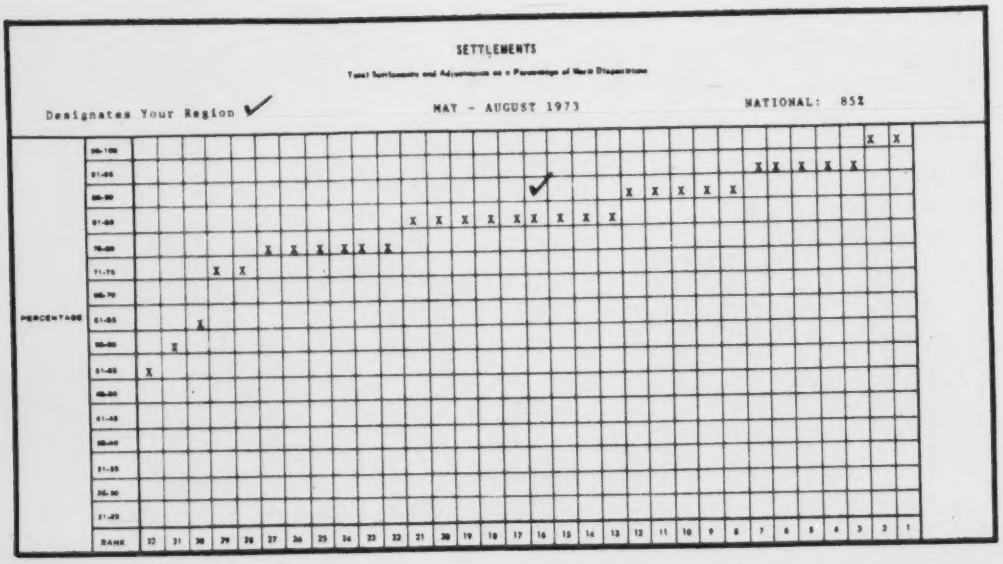
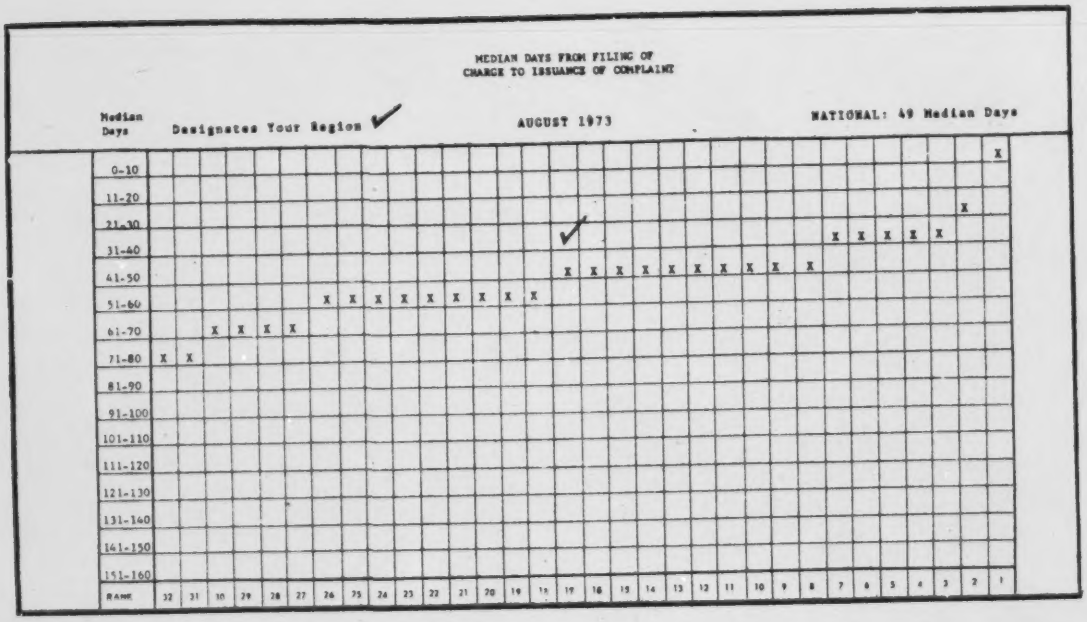


EXHIBIT 3

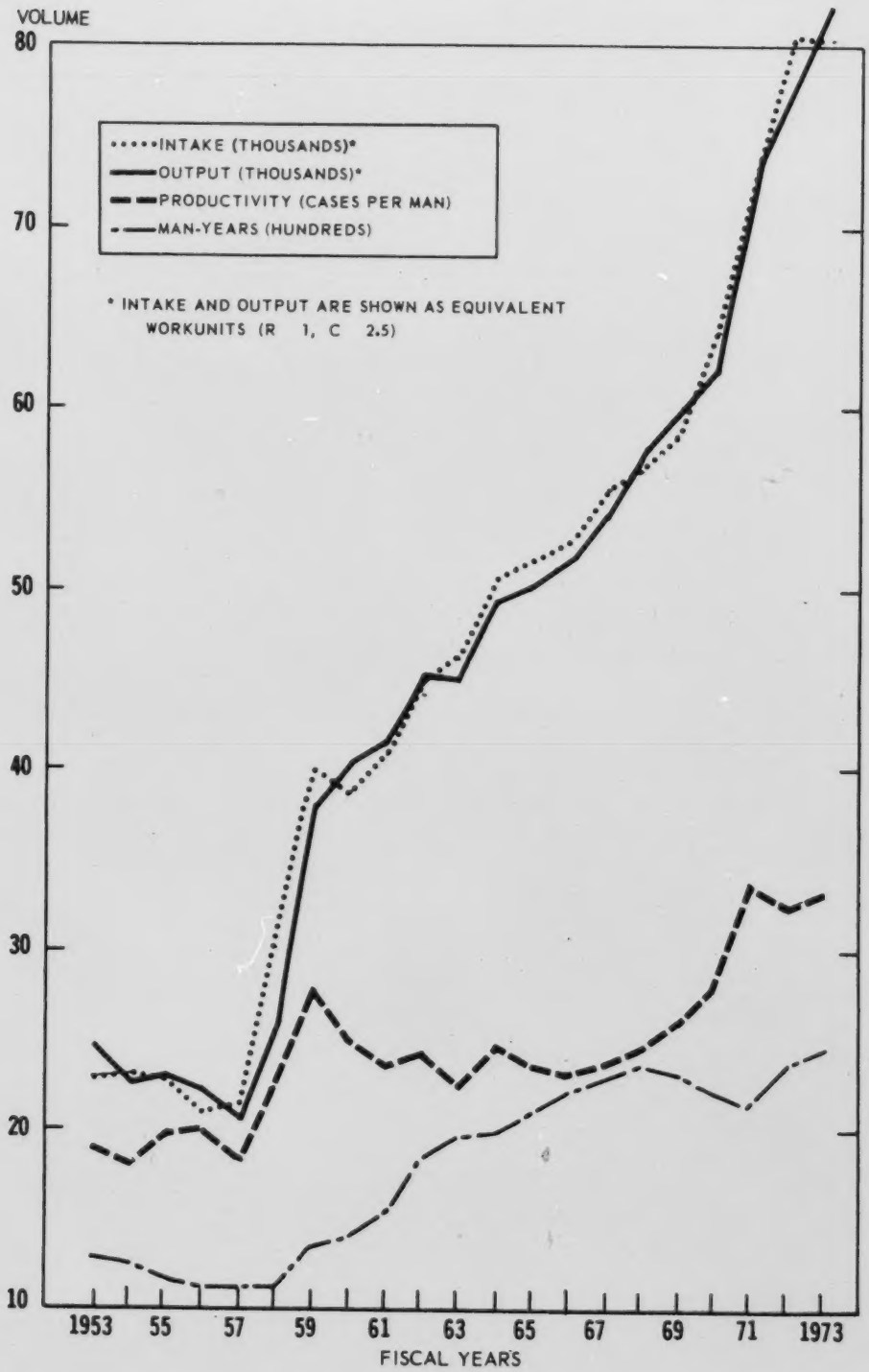


For example, the established time objective for the investigation and determination of merit of an unfair labor practice charge is 30 days. Action following that decision in the form of dismissal, withdrawal, settlement, or complaint should occur within 15 days. Thus, in an unfair labor practice case in which merit is found by the Regional Director and no settlement is achieved, the complaint and notice of hearing should issue within 45 days of filing of the charge. The NLRB seeks to close an unfair labor practice hearing in an additional 45 days from issuance of complaint.

Upon receipt of over-age case reports in Washington, they are tabulated. The reasons for the delinquent status are reviewed. An Assistant General Counsel reviews the performance of his assigned Regions. Consequently, a Regional Director will receive a monthly survey of the performance of his office from his Assistant General Counsel. This survey identifies areas for improvement and a continuing perspective of case handling objectives. Performance standings are graphically illustrated. (See check marks, Exhibits 2 and 3.)

In terms of results, NLRB productivity measurement has contributed to marked improvements in service to the public and more efficient expenditure of the tax dollar. Between 1958 and 1971, for example, case intake increased 122 percent. In 1958, the median age of cases pending in preliminary investigation was 52.5 days. It took 116 days in 1958 to carry a case from filing to complaint. These times have been reduced to 22.8 and 51 days, respectively. Similar improvements have been achieved in practically all areas of professional performance. (See Exhibit 4, below.)

NLRB INTAKE, OUTPUT, PRODUCTIVITY



These achievements obviously are not attributable entirely to the production information systems. However, the systems provide a took which, in the hands of motivated managers, enable them to further the Agency objective of securing prompt and fair resolution of industrial disputes.

FUTURE PLANS

Recently the NLRB initiated management measurement studies in its Division of Administration. The identification and measurement of service functions will assist this Division's managers in planning, scheduling, and budgeting nonlegal duties and needs.

Barring further substantial changes in the Act itself, near-term major changes in the measurement of productivity are not expected. However, substantial changes in the manner in which this information is secured are predictable as more data is provided with computer systems.

CHAPTER 8

PRODUCTIVITY CASE STUDY

OF

FARMERS HOME ADMINISTRATION

BACKGROUND

The Farmers Home Administration Act of 1946 combined the responsibilities of two organizations: the Farm Security Agency and the Emergency Crop and Feed Loan Division of the Farm Credit Administration. Some of the functions assigned to the Farmers Home Administration (hereinafter referred to as FmHA) were performed by the Farm Security Administration (created in 1937) and the Resettlement Administration (1935).

The basic mission of FmHA is to channel credit to farmers, rural residents and rural communities and to help borrowers gain maximum benefits from loans through counseling and technical assistance. FmHA has several types of loan and grant programs to help with the purchase or operation of farms, homes, business opportunities, community improvements, etc.

The FmHA is one of twenty program agencies in the Department of Agriculture. At Headquarters the Administrator has two Deputies, the agency Comptroller and the Deputy for Program Operations. Operating divisions are organized by types of loan and grant programs. The agencywide National Finance Office in St. Louis processes all loan and accounting transactions.

The total employment of FmHA on March 31, 1974 was 7,791. The Field organization consists of 42 State Directors, 264 District Directors and 1,744 county offices. The County Office is the basic work unit. Staffing in these offices ranges from 2 to 7 employees, including part-time clerks. An average County Office may consist of a supervisor, an assistant, one full-time clerk and one part-time clerk.

SOURCE: Department of Agriculture

None of these data include the 5,000-plus "County Committeemen" who attend specially-convened meetings to review loan and grant applications or participate in problem solving. They work on an "as needed" or WAE (When-Actually-Employed) basis.

EVOLUTION OF WORK MEASUREMENT SYSTEMS

Productivity measurement is based on input and output data developed in the FmHA work measurement system. Since the 1930's the basic loan and grant making operations performed at county offices have been measured. At first only limited statistical analyses of the total number of documents processed were made. However, the measurement systems used have been regularly reviewed, validated and improved.

During the period 1942-1963 separate time studies were made of all field office activities and for each of the several types of loans. Random sampling was begun whereby only a few field offices in selected states were required to measure certain types of loans. Nationwide statistical averages were developed for processing each type of loan. Weighting factors based on workload volume were used to evaluate each state's performance.

Improvements from 1964-1970 included:

1. Enlarging the percentage of offices included in the samples.

2. Adding time measurement of program and administrative support operations at the county level.

3. Developing a guide to assist program and management planners in equitable distribution of personnel, isolating administrative costs, strengthening training and supervision and determining trends in operations.

The present work measurement system includes the accounting of time on administrative and support functions by personnel in Field Offices. The County Offices selected for

sample reporting are now stratified into four groups, based on composite weighted workload volumes. Each year a new list of counties are selected for the sample in each group. Weekly work measurement reports are forwarded to the FmHA Finance Center for summarization, weighting and tabulation.

PRODUCTIVITY MEASURES

When the Federal Productivity Measurement Project began in 1971 the Department of Agriculture selected Farmers Home Administration as one of ten agencies to be included. One of the reasons was their long history of output measures readily available. It took a minimum of effort to develop a one-line output for the entire agency. The work measurement system had produced single-line composite outputs for each of the 20+ loan and grant programs. By selecting a common production rate (output per-man-hour) all program outputs were weighted and totalled for the single line agency composite output. Man-years of all County Office direct measured work, as well as support effort of State and County Office workers were available from work measurement records. It was not difficult to add the administrative support man-years of the Finance Center and Headquarters personnel. Data on wages for measured and non-measured effort were derived from Finance Center accounting records and the Department's centralized payroll system.

The trends of output, input and producitivy from FY 1967 through FY 1973 are shown in the following chart, Exhibit 1.

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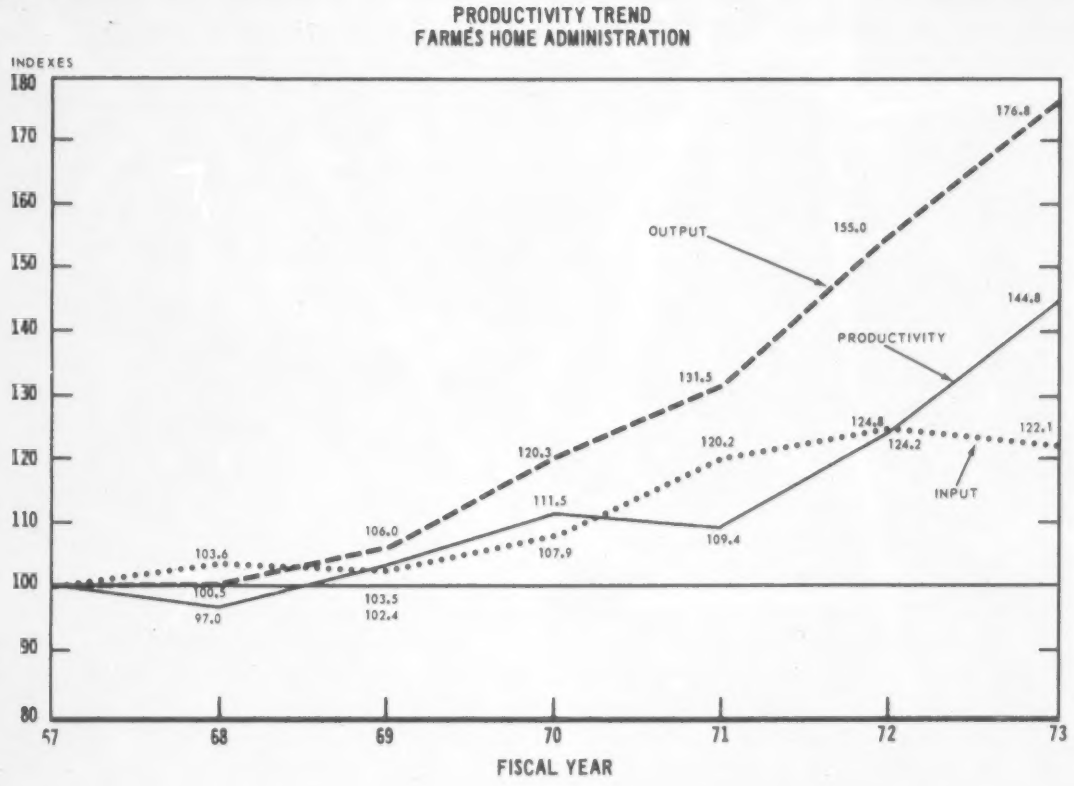
EXHIBIT 1



Productivity Trends and Causes of Change

As shown on the chart, productivity showed remarkable improvements during the period FY 1967-1973. Output is up 77 percent while man-years increased only 33 percent, resulting in a productivity gain of 43 percent. The wage index rose 84.24 percent, but during the same period the current (deflated) unit cost decreased $9.13, (from $25.21 to $16.18).

Numerous factors contributed to the overall productivity improvement in the FmHA programs. Sharp increases in the workloads of some major programs resulted from legislative or administrative changes. As examples:

1. New provisions for special minimal interest loans to very low income large families caused Rural Housing Loans to Individuals to rise from 48,437 in FY 1967 to 119,783 in FY 1973.

2. The emphasis on providing low cost housing brought a steady climb in the Rural Rental Housing Loan Program from 111 to 730 during the FY 1967-1973 period.

3. Executive initiative to improve Federal Assistance to rural communities resulted in a 40 percent increase in Water and Waste Disposal Loans.

4. Hurricane Agnes caused a sudden surge in Emergency Loans in 1973.

The increases in loans are illustrated in the following charts (Exhibits 2, 3, 4, and 5).

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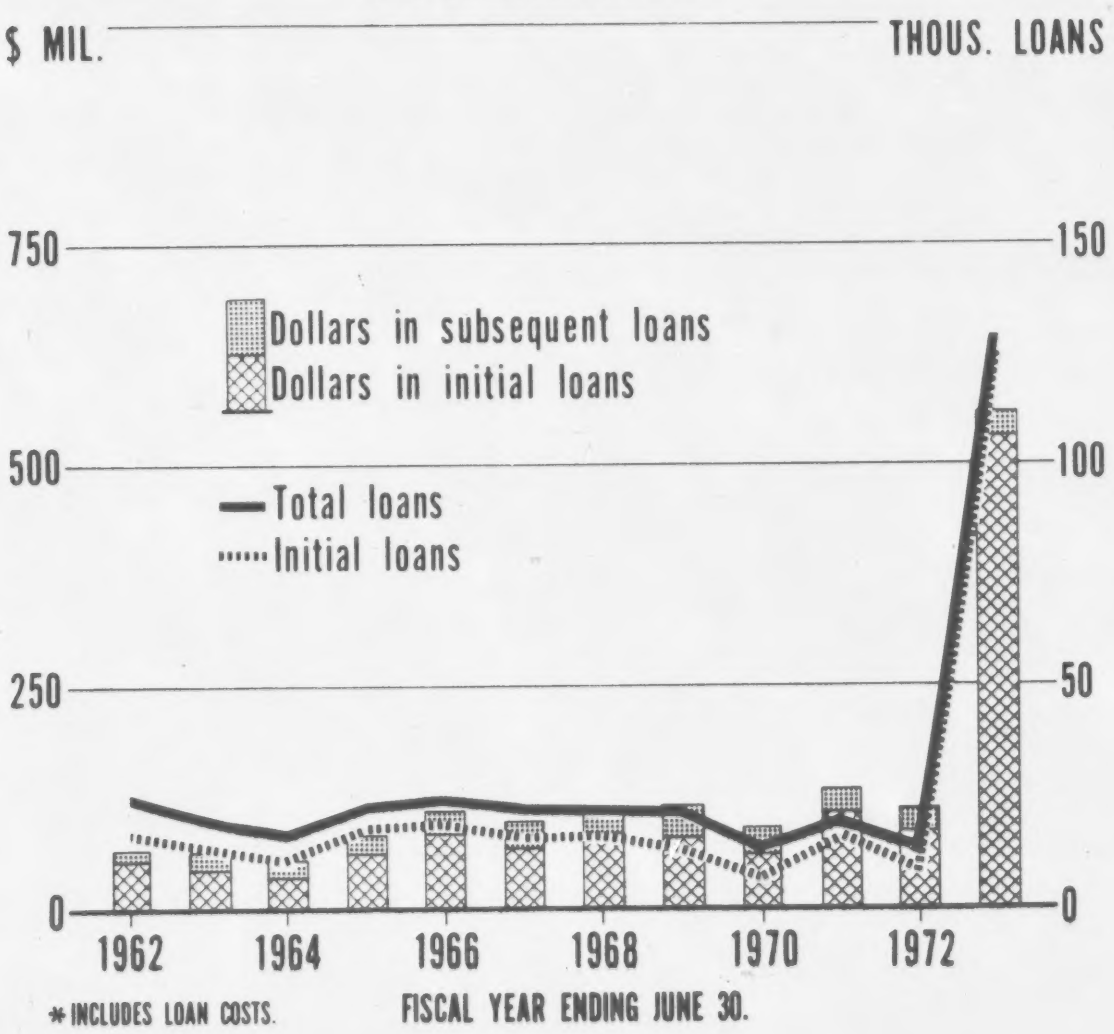
EXHIBIT 2

FHA Special Project, July 1973

EMERGENCY LOANS, NUMBER OF LOANS, DOLLARS LENT*

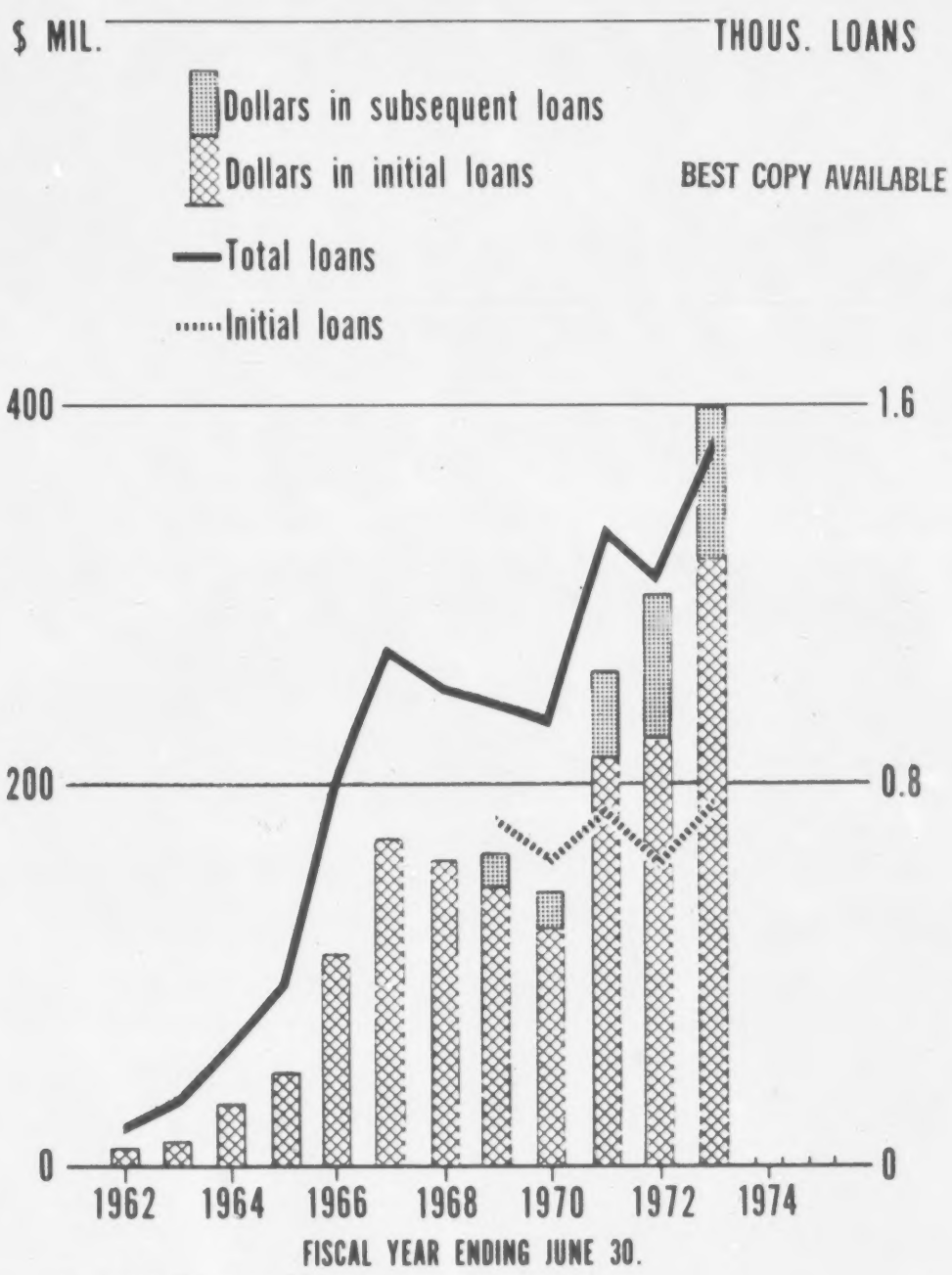


*INCLUDES LOAN COSTS.

FISCAL YEAR ENDING JUNE 30.

FHA Special Project, July 1973

WATER WASTE DISPOSAL LOANS, NUMBER OF LOANS, DOLLARS LENT*



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* INCLUDES LOAN COSTS

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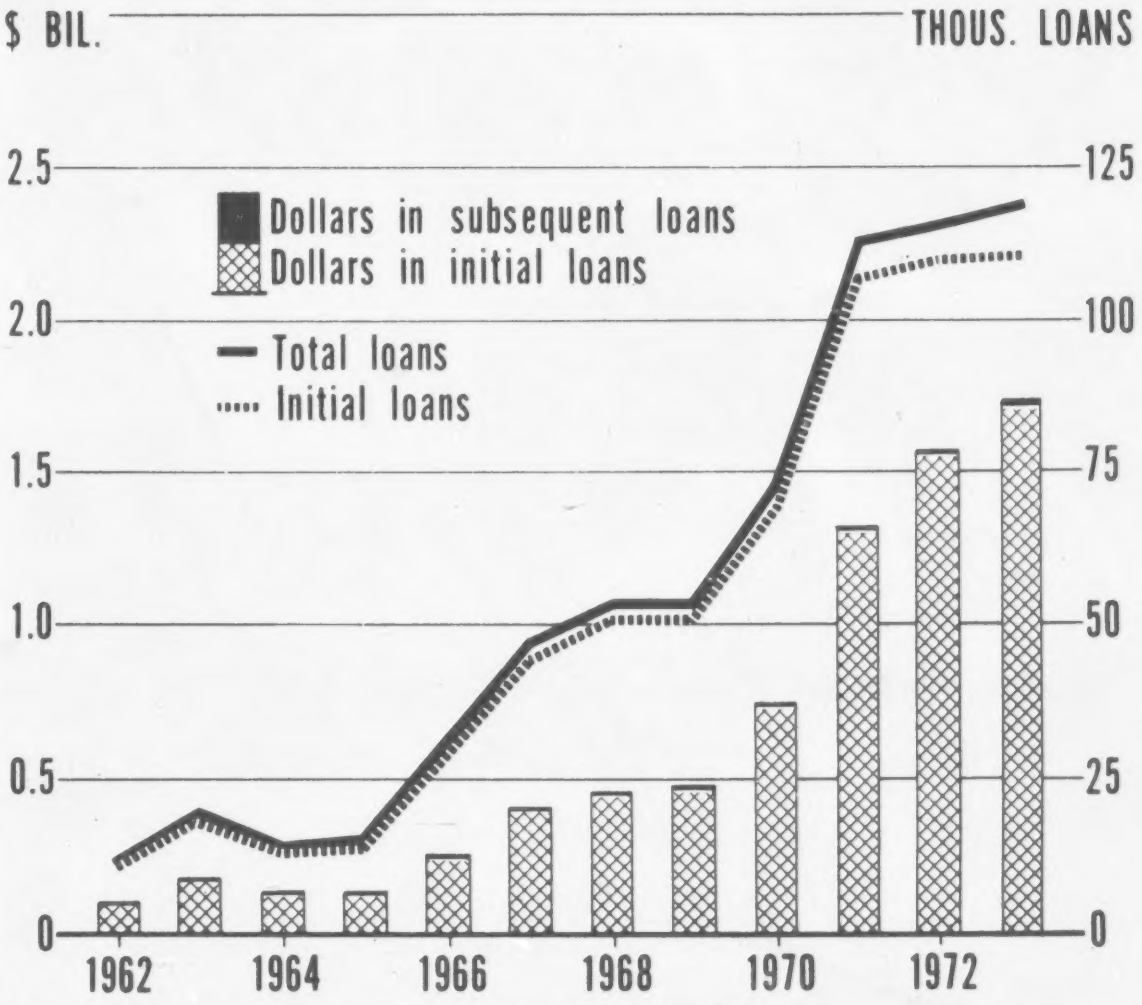
EXHIBIT 4

FHA Special Project, July 1973

RURAL HOUSING LOANS TO INDIVIDUALS, NUMBER OF LOANS, DOLLARS LENT*



* INCLUDES LOAN COSTS.

FISCAL YEAR ENDING JUNE 30.

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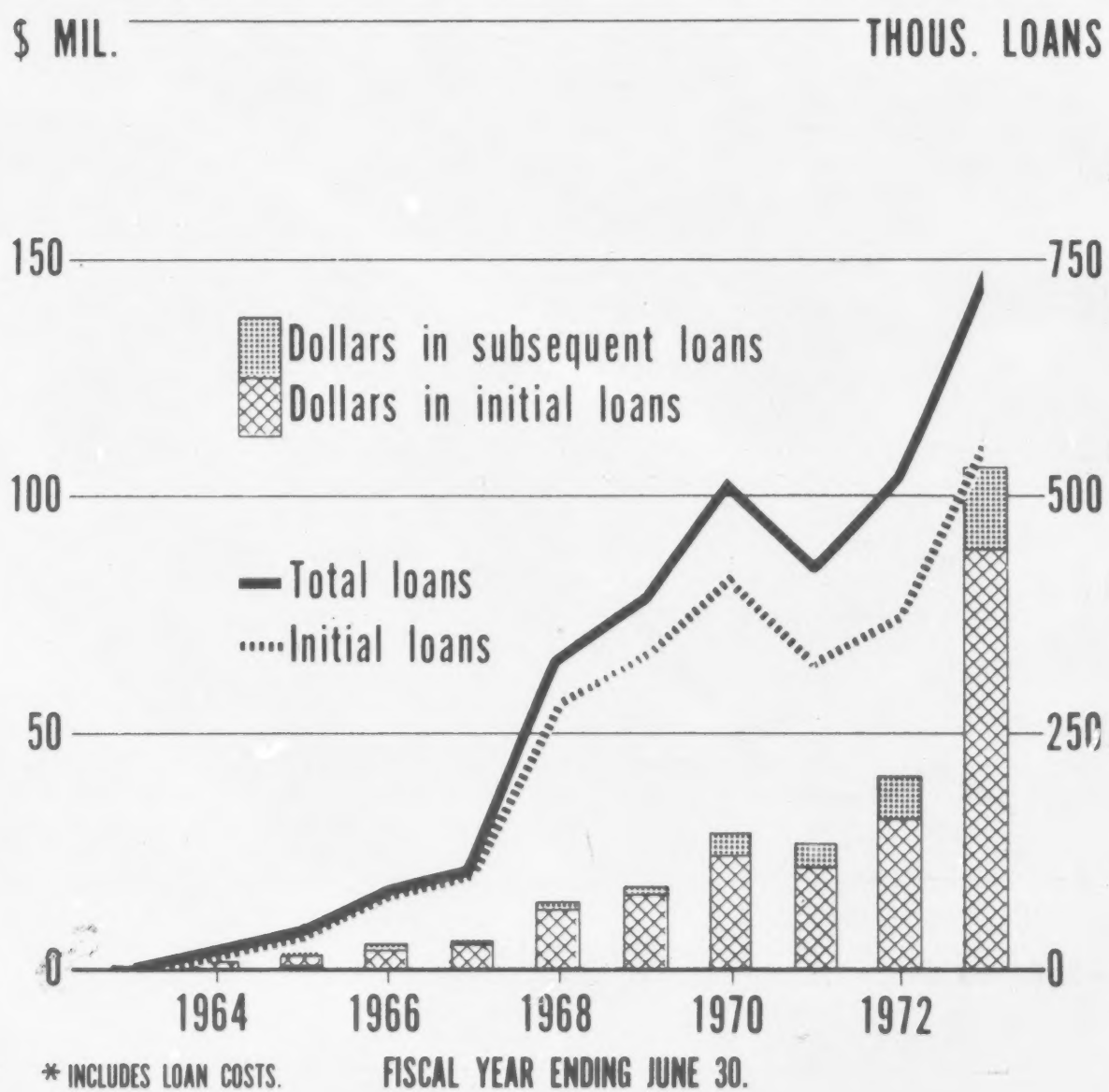
EXHIBIT 5

FHA Special Project, July 1973

RURAL RENTAL HOUSING LOANS, NUMBER OF LOANS, DOLLARS LENT*



* INCLUDES LOAN COSTS.

FISCAL YEAR ENDING JUNE 30.

Administrative actions to absorb the heavier workloads include:

1. Authorizing the use of Escrow Agents to close loans, thereby eliminating the need of FmHA personnel to be present at closings.

2. Initiating direct payments to the National Finance Office. Formerly, borrowers made payments to local County Offices where individual loan records were maintained. Loan records at the NFO were automated.

3. Authorizing the use of "Interim Financing" (during construction) prior to making an FmHA mortgage loan, thereby eliminating "piecemeal" periodic payments for "work put in place."

4. Increasing the emphasis on training. A greater number of training courses were made available at the Agency Training Center and course participation increased accordingly.

IMPACT OF PRODUCTIVITY ON QUALITY

One of the measures of the quality of staff work in a loan program is the change in delinquency rates as volume changes. The sharp increase in Rural Housing Loans to Individuals, following the provision for lower income families to qualify for reduced interest loans, brought new problems to the FmHA staff and field personnel. Many of these families had never owned property or made regular loan payments before. The big impact was felt from 1970 to 1973 when the number of loans jumped from 73,351 to 119,783. Yet the delinquency rate during this period only rose from 11 percent to 16 percent. Strong emphasis on quality applicants and loan servicing, along with the dedication of staff and field workers, were responsible for holding down what could well have developed into a much higher delinquency rate. Program evaluation teams, comprised of state, district and county supervisors visited various FmHA field offices to observe their successful practices and to share them with others. County Office supervisors provided direct counseling to many low income buyers to motivate them to accept the responsibility to keep their loan payments current.

A comparison of delinquency rates for ten major FmHA programs during the period 1969-1973 is shown in the following chart (Exhibit 6). In 7 of the programs the percentage of delinquency dropped.

EXHIBIT 6

PERCENT OF ACTIVE ACCOUNTS DELINQUENT

FOR TEN MAJOR PROGRAMS

AS OF DECEMBER 31

Program	1969	1970	1971	1972	1973
Farm Ownership	16	17	16	16	12
Farm Operating	35	38	36	36	29
* Rural Housing (Ind.)	8	11	12	15	16
Soil & Water (Ind.)	16	17	14	16	13
Rural Rental Housing (Ind.)	7	8	8	11	9
Labor Housing (Ind.)	12	20	15	20	10
Domestic Water	9	13	11	11	7
Waste Disposal	4	10	7	6	4
Grazing	7	11	11	11	5
Irrigation & Drainage	6	8	6	6	4

*In 1969 the Agency was authorized to help lower income families through the use of Interest Credit Loans.

USES OF PRODUCTIVITY MEASURES BY MANAGEMENT

Work measurement time studies have resulted in the development of U.S. hourly rates for making or servicing the various types of FmHA loans and grants. These rates can be applied to the workloads of any County Office to determine its overall "total weighted workload." This is one of the factors used by managers at various levels in the agency to:

1. Assist in the evaluation of current personnel needs of County or State Offices.

2. Compare workloads of County Offices or State Offices.

3. Assist in determining the locations of County Offices.

The Budget Division uses work measurement and productivity data to determine costs for each loan and grant program. Hourly Cost Rates are used to determine the total cost of the projected volume of loans to be made during the budget year. Overhead costs are prorated for each program to obtain total program projected costs.

When administrative or budget cuts must be made work measurement data are useful in distributing the cuts equitably.

OUTLOOK FOR THE FUTURE

During the near future it is expected that the number of Housing Loans will increase, Farm Ownership loans may decrease, and a new program is expected to initiate over 200 loans per year for Industrial Development in rural areas. Total FmHA year-end full-time employment is expected to decrease from 7,165 on June 30, 1973, to 6,535 to June 30, 1975. More part-time and temporary employees will be used and total manyears of employment are expected to decrease from 8,607 (FY 1973) to 7,901 (FY 1975).

Administrative actions planned to increase overall productivity include:

1. The agency is attempting to enter into a contract for reporting of real estate tax delinquent payments by FmHA borrowers. This should ease the burden on County Offices in tracking tax payments.

2. FmHA has negotiated with companies insuring FmHA borrowers' properties to notify County Offices of delinquent payments 30 days before cancellation. This will also remove some of the burden from County Offices. They formerly would make delinquent premium payments then collect from the borrowers.

3. Currently the frequency of loan payments varies. Some make only 10 payments a year. The aim now is to standardize all payments on a straight monthly basis to alleviate some of the bookkeeping workload.

Changes in program direction to improve productivity include:

1. A shift toward more FmHA-guaranteed loans and less direct FmHA loans. Commercial lenders would do more of the loan making and servicing.

2. The agency will be encouraging private lenders to make concurrent participating loans to FmHA borrowers (similar to second trusts). In some cases this could require more work for FmHA.

A Task Force Report from a study of the agency's policies, procedures, operating instructions and forms has made several recommendations which are being considered. Many of these, if feasible, could help to improve overall productivity.

CHAPTER 9

MANAGEMENT USE OF PRODUCTIVITY MEASURES IN THE BUREAU OF ENGRAVING AND PRINTING

The Bureau of Engraving and Printing, Department of the Treasury, one of the world's largest securities manufacturing establishments, is responsible for designing and producing most of the major evidences of a financial character issued by the United States. It is the sole source for the production of United States currency, postage stamps and public debt instruments, as well as miscellaneous financial and security documents.

FUNDING

Operations of the Bureau are financed by means of a revolving fund established in accordance with the provisions of Public Law 656, approved August 4, 1950. This fund is reimbursed by customer Government agencies for the direct and indirect costs of the Bureau, including administrative expenses, incidental to performing the work and services requisitioned.

COST-EFFECTIVENESS MEASUREMENT

The Bureau maintains an accrual system of accounting. Results of operations are reflected on a cost-performance basis in line with principles recognized by private industry, thereby providing Bureau officials with the necessary data for effective management of all resources--manpower, materials, and equipment.

To accomplish cost control objectives and provide the necessary insight into the operations of each activity, monthly unit cost rates, which relate the physical work units produced in a given cost center to corresponding costs, are employed to measure efficiency for each operation through which a product passes, against the Bureau's financial plan. Unit cost rates identify increments of material, labor, and overhead costs charged to each production process. Daily production data reports of the quantity of work produced and the number of hours worked by employees on a given process, according to product, provide the input for

SOURCE: Bureau of Engraving and Printing

labor costs. Sectional overhead costs, which include such items as indirect labor, manufacturing supplies, and depreciation charges on equipment, are distributed to the functions performed on each product in a given cost center. Distribution is made in the relationship that the direct labor costs incurred on one product bears to the total direct labor costs for all products being processed. Computation of the final unit cost rate is developed by allocating to the accumulative manufacturing cost of the individual products in a given month a pro rata share of the total administrative and general costs. These costs represent the uncapitalized costs of maintenance and engineering services, and administrative functions, such as procurement, accounting, and personnel.

Analysis reports of results of operations under the Bureau's cost accounting system brings to the attention of management conditions which may be hampering an activity from achieving maximum operating efficiency. Managerial attention is concentrated upon the operating results each day through the medium of production reports prepared in the manufacturing cost centers to identify production attained on a given day with the available manpower resources. These same daily production data reports serve as the basis for developing forecasts of manpower requirements of direct labor employees to meet projected workload estimates developed with customer agencies.

COST IDENTIFICATION FOR

RESEARCH AND DEVELOPMENT AND CAPITAL EXPENDITURE

Daily manpower utilization reports are supplemented by month-end statements of the results of operations in terms of costs. The most important of these is a comparative statement of product costs which shows the results of operations for all of the major products, comprising approximately 90% of the work volume of the Bureau. These statements bring to the attention of management any unfavorable trends developing in the cost of a product. In addition, they provide a cost-effectiveness reference for research and development programs leading toward program improvement, or capitalization for mechanization of the more costly work processes. It was through such cost-effectiveness analysis that studies were initiated which led to the Bureau's development of the prototype model of the custom-designed

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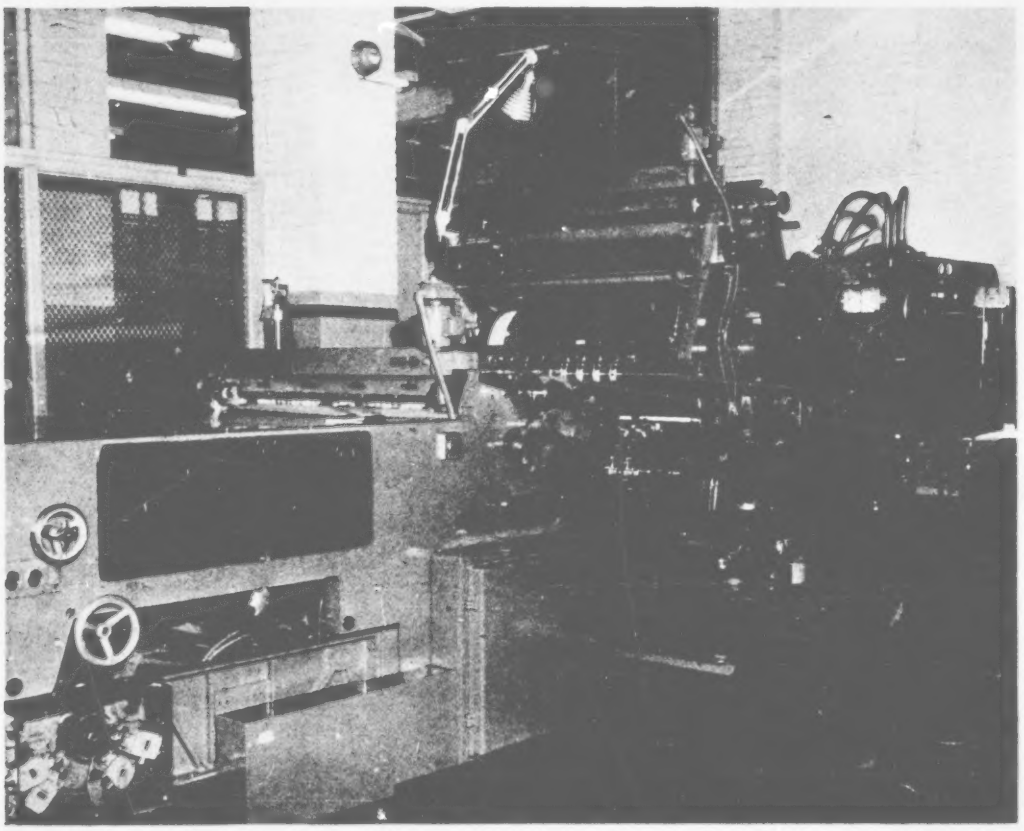
Currency Overprinting and Processing Equipment (COPE). This equipment is designed to affix the serial number and cut the sheets to bill size. Complete conversion to such automation through lease/purchase agreement will result in a substantial decrease in manpower requirements and associated production costs. Each machine will save 32.8 manyears or a net savings after costs of $165,000 per year for 5 years. (See Exhibit 1)

EXHIBIT 1



CURRENCY OVERPRINTING AND PROCESSING EQUIPMENT (COPE)

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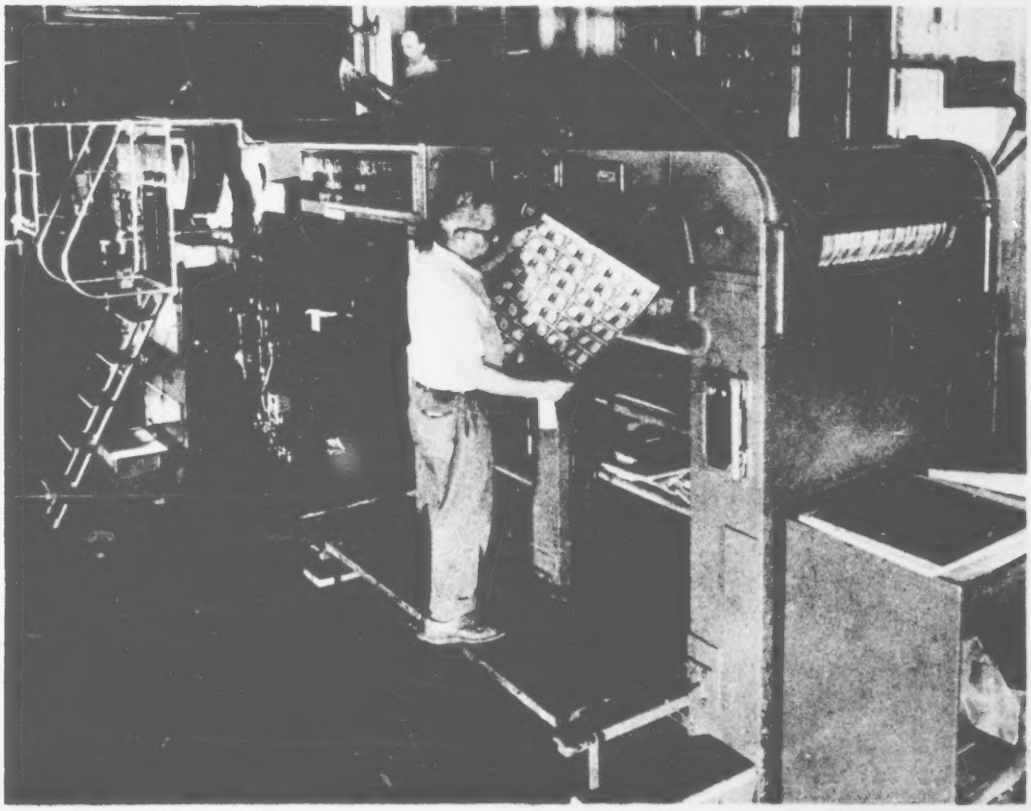
Another example, shown in Exhibit 2, is the Giori-Sheet-fed, rotary currency press which prints currency sheets at a rate 2.5 times greater than the old press. This will result in savings of $170,000 per press per year. The press costs $1 million and a total of 6 have been purchased.

EXHIBIT 2



GIORI - SHEET-FED, ROTARY CURRENCY PRESS

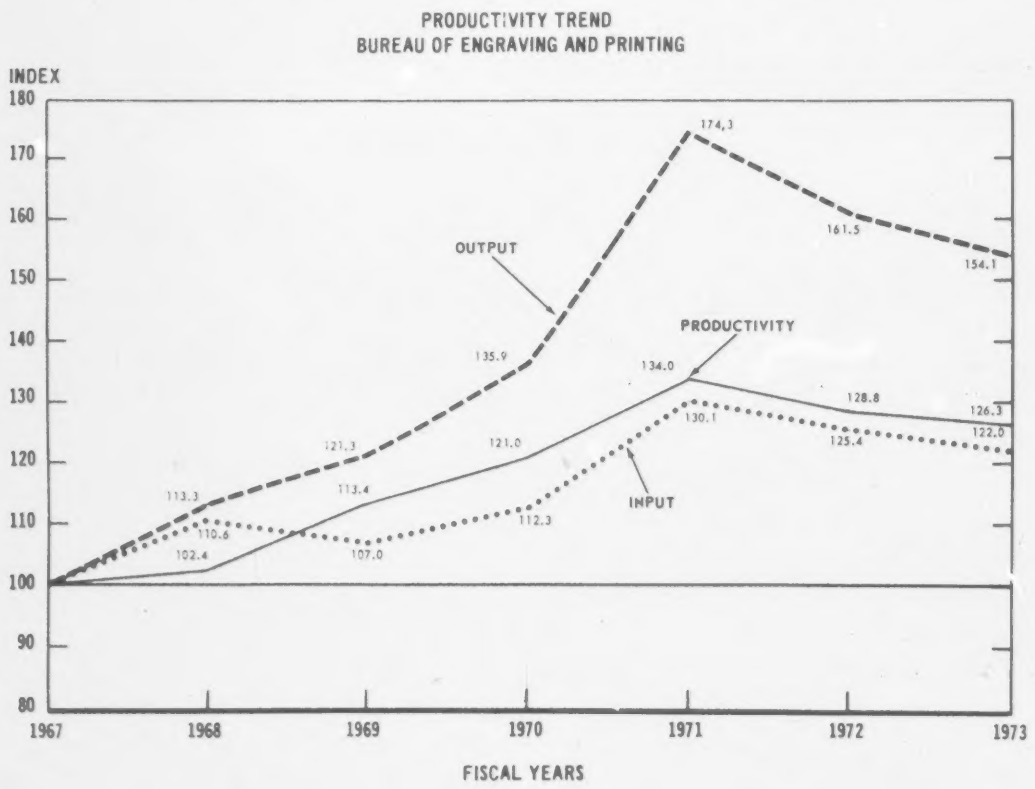
As a result of continued investment in better equipment within the available funding and numerous management improvements in labor-intensive areas, the Bureau has achieved increased productivity in spite of significant increases in materials costs and labor rates.

PRODUCTIVITY TREND, FY 1967 TO 1973

The output index consists of the major Bureau products such as currency notes, sheet postage stamps and Treasury bills.

As shown in Exhibit 3, productivity increased during the period by 26 percent or an average annual rate of 4 percent. Without this improvement in productivity, BEP would have required another 1,000 employees to accomplish its rapidly increasing workload. The upturn in productivity for FY 1970 over FY 1969 was due to productivity increases in currency, food coupons, and Treasury bills. In April 1969 the speed of the newer currency presses was increased, leading to part of the currency productivity increases in that year, and to further increases the following year. The increase in food coupon productivity in FY 1970 was in part due to acquirement of a mechanical collator.

EXHIBIT 3



The sharp upturn in productivity in FY 1971 was due to significant increases in currency production following installation of the "Perfect Package Program." In addition, postage stamp production increased due to improvements in inspection and processing procedures.

It will be noted that productivity decreased in FY 1972 and FY 1973. Many reasons are involved. The major reason is the higher costs in the administrative and general overhead areas. Costs rose from 41.6 percent in FY 1971 to 47.2 percent in FY 1972 and to 51.2 percent in FY 1973. Improvements in quality control procedures, coupled with the phasing out of food coupon production beginning with FY 1972, are the major reasons for the increased percent of administrative and general costs.

HUMAN RESOURCES MANAGEMENT

In recent years, Bureau management has intensified its efforts to develop and improve the productivity of its significant human resources. A results-oriented approach has been taken in labor-management relations with the 18 employee unions, and in the redesign of all personnel management systems. Following are summaries of key areas:

A. Work Performance: Synthesized and coordinated promotion, performance evaluation, and incentive award plans, have established good-work-performance as the common denominator for recognition and reward. Written tests, formal education requirements, and other extraneous criteria were either eliminated as non-relevant in the bulk of semi-skilled work situations, or made secondary to the employee's work performance in eligibility for promotion, awards, etc.

B. Training: The strength of comprehensive training efforts is testified to by the fact that Bureau employees expressed in a recent attitudes survey an overwhelming belief that they are well trained for their jobs. Further, special supervisor training in stimulating employee productivity through such means as job enrichment, participative management, use of incentives, etc., is done on a continuing basis through established supervisor seminar programs.

C. Communications and Feedback: A variety of means, ranging from an 18-week series of Bureau-wide employee seminars called "Employee Convention Days", to a recent professional total employee opinion survey, have been employed to generate employee feedback used to assess the effectiveness of policies and personnel programs, as well as to help identify general managerial strengths and weaknesses. It is Bureau management policy that employee-involvement is essential to productivity achievement in a constant environment of modernization.

D. Executive Development: A Bureau Executive Manpower Resource Board administers all executive development programs. The Assessment Center technique has been recently introduced for the identification of managerial potential among those who do not get visibility otherwise. This project was developed with the Civil Service Commission's Personnel Management Research and Development Division, and initiated in the Bureau in March, 1974.

E. New Productivity Incentives: Based on the confirmation in recent attitude surveys of high employee pride, quality awareness, and positive productivity inclinations, preliminary talks have been held with the National Commission on Productivity regarding the potential for a pilot installation of the Bureau's concept for an innovated incentive bonus plan, based on group productivity. Although such "Scanlon-type" plans have been used successfully in the private sector, they have not been attempted in government. Therefore, the Bureau is proceeding carefully in assessing the potential of such a challenging approach to improving the productivity of human resources.

LONG-RANGE PLANNING AND FUND AVAILABILITY

The Bureau's long-range plans are continuously being re-examined on the basis of estimated workload requirements and manpower availability, as well as for identification of potential technological improvements which may be effected in various facets of this essentially unique operation. Such 5 to 10 year projection studies are essential to anticipate the state-of-the-art, to achieve research innovation, to provide lead-time for the design of custom equipment, and to develop funding for the construction and acquisition of production models of such equipment.

To continue to meet these objectives there is a need to improve the process for making funds available for larger capital investment in equipment and facilities. Since the inception of the revolving fund the Bureau has depended solely on funds generated through depreciation to finance updated equipment purchases. However, the limited funds which were available through such depreciation accumulation have seriously inhibited the Bureau's ability to take advantage of internal and external technological developments in the graphic arts. The inadequacy of the 1950-established fund to meet the increase in real costs of more technologically sophisticated equipment needs was only partially alleviated by recent appropriated additions to the fund.

NEW FINANCING APPROACHES

The Bureau is actively pursuing a two-pronged approach to achieve solutions to this problem.

One of the major constraints in entering into the usual lease-purchase agreement is the Federal procurement requirement to have a reserve of funds to support any liquidating damage resulting either from termination or non-exercise of any renewal option. Through pre-invitation discussion with competitive potential suppliers, the Bureau achieved unique proposals for lease-purchase without the liability contingency, and has been able to order major press and processing equipment valued at approximately $13 million without a cash outlay, or funded reserve. Annual recurring savings in currency cost through this acquisition will approximate $3 million.

The Bureau will also inaugurate in July, 1974, an additional technique to finance future capital improvements by including, as needed, a surcharge in the selling price of its products. The specific amount of the surcharge will be calculated annually by a formula based on the total estimated cost of equipment to be acquired in any given year, after taking into consideration the amount of cash to be generated internally by normal depreciation of equipment already on hand in the Bureau.

The Bureau believes a change in Public Law 656, which established the revolving fund, to grant the Bureau authority to borrow funds from the general fund of the Treasury would be a viable approach to financing capital improvements. Borrowing authority would significantly shorten the lead-time requirements for identification of new equipment needs--which is inherent in the accumulation of funds through surcharge. Repayment of the borrowed capital and associated interest charges would be borne by customer agencies monthly through the billing rates.

Looking ahead, the Bureau anticipates that the availability of depreciation funds through the existing revolving fund, the utilization of surcharge accumulation for long-range capitalization needs, and borrowing authority to permit capitalization of emergent requirements or current technological advances, would permit the most flexible management of capital resources to maintain and improve productivity in an environment of increasing costs.

CHAPTER 10

PRODUCTIVITY IMPROVEMENT IN THE BUREAU OF THE MINT

INTRODUCTION

The Bureau of the Mint is primarily responsible for providing sufficient coinage for the economy by manufacturing and distributing United States coins to the 36 Federal Reserve Banks and branches and to the Treasurer's Office in Washington, D.C. The Mint fulfills these objectives at three coin production facilities located in Philadelphia, Pa., Denver, Colo., and San Francisco, Cal.

Since 1792, when the United States monetary system was established, there have been more than 130 billion U.S. coins produced and distributed. While the manufacture of coins is of the utmost importance in fulfilling the Mint's mission, of equal importance is the handling of these coins within the coining facilities and their eventual distribution to the Federal Reserve Banks. It is this latter function, the handling and distribution of coins at the Philadelphia Mint, to which this study is addressed.

BACKGROUND

The Philadelphia Mint has produced approximately 60 billion coins since it began operation in 1793, with 25 percent of this total (approximately 15 billion coins) being manufactured over the last five years. Since the handling of these large numbers of coins adds nothing but cost to the finished product, it was only logical that management give particular attention to the methods and procedures for handling finished coin. This was especially true during the coin shortage of 1965, when unprecedented production levels were reached, and thereafter to the rapidly rising demand for coins throughout the economy.

During the period 1965-1967 there were many discussions and studies searching for new approaches for moving and storing coins before shipment. These efforts were futile and the old procedures prevailed, in part due to the

SOURCE: Bureau of the Mint

physical construction of the Philadelphia Mint building. Under the old method, the bags of finished coin would be hand loaded onto wooden pallets (a platform for storage and/or transportation) and moved into storage vaults via electric or hand trucks to await shipment to the Federal Reserve Banks (see Figure 1). During the periods of peak production or low demand, when inventory levels rose considerably, it was necessary to unload the pallets manually and stack the bagged coins on the floor of the vault. This was necessary because of the limited storage space available, and a reluctance to stack loaded pallets made of wood for fear of them toppling over.

FIGURE 1

BAGGED COINS ON WOODEN PALLETS AWAITING SHIPMENT TO THE FEDERAL RESERVE BANKS

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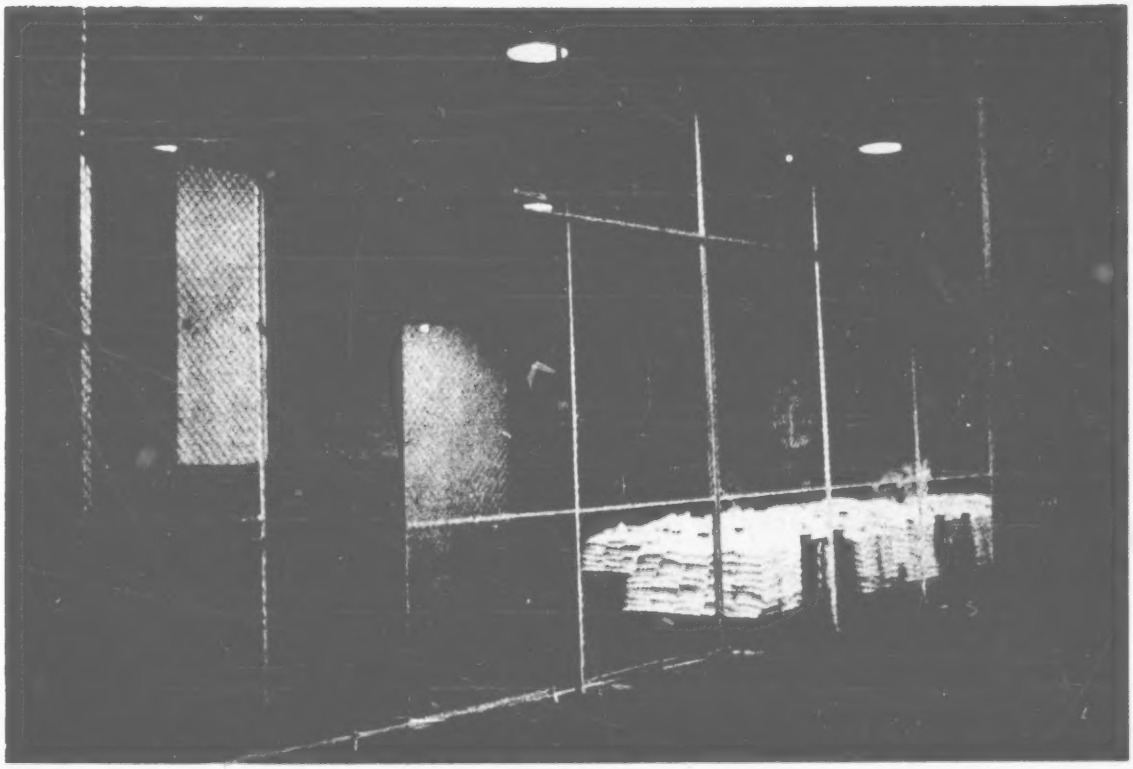

When Federal Reserve orders were to be filled the wooden pallets would be moved to the shipping area for hand loading over-the-road trucks. If coins had been stacked on the vault floor it was again necessary to hand load the pallets prior to movement to the shipping area. At the loading docks it was required that at least one and possibly more men would assist in stacking the coins in the bed of the truck (see Figure 2), even though it was primarily the responsibility of trucking personnel to do the loading. This approach to the coin handling activities consumed large amounts of time and the number of coins shipped was approximately 100,000 coins per manhour.

FIGURE 2

BAGGED COINS ON WOODEN PALLETS BEING HAND LOADED ON TRUCK

FOR DELIVERY TO FEDERAL RESERVE BANKS

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At the receiving location Federal Reserve Bank personnel would pick up the bagged coin at the unloading docks and stack them by hand in their vaults. This activity again demanded a large number of manhours.

During the construction of a new Philadephia Mint in the latter part of the 1960's, a Joint Committee consisting of Mint and Federal Reserve personnel was formed. Their objective was to meet on irregular occasions to study and arrive at a mutually acceptable approach for improving the coin distribution system, while bearing in mind the improved construction capabilities of the new Mint. These capabilities included the unimpeded flow of material throughout the building that made it most suitable to changes in coin handling. In less than two years after opening ceremonies (August 1969), the committee had designed a new-type pallet to move and store coins.

The new pallets were constructed of steel and had two end panels to aid in supporting bagged coin. These panels would fold flat for return shipment or storage. A stack of four loaded pallets was recommended for storage. Each pallet weighed 160 pounds with an overall dimension of 30 inches long by 20 inches wide by 30 1/2 inches high.

The use of the steel pallets began, on pilot plan basis, in the spring of 1971 and immediately productivity gains were realized. The coin handling activity then consisted of just one complete operation of loading the pallets and storing them until coin orders were to be filled (see Figure 3), and then delivering them to the loading docks for shipment. When the exclusive utilization of steel pallets began in FY 1972, there was no longer any repetition in handling the bagged coins within the Mint. However, even under these procedures the employees of the shipping area were still required to assist in the unloading of pallets onto the trucks.

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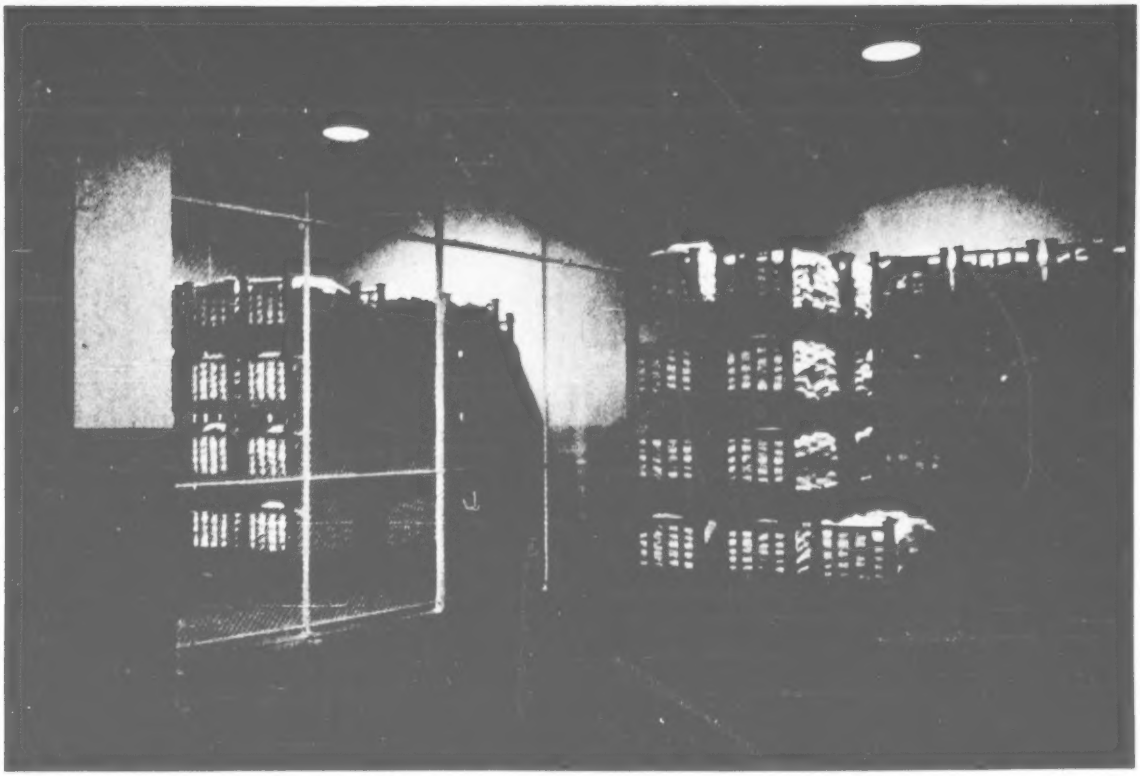
FIGURE 3



Prior to, or at approximately the same time that the Mint began using steel pallets the Federal Reserve Banks, after many months of deliberation and examination by a Sub-committee, decided to purchase a number of these pallets for internal use. They too discovered immediate productivity gains in utilizing steel pallets.

Since the loading of trucks was accomplished by hand, the next logical step was to palletize the entire system of coin movement. After months of devising a system for pallet returns and accountability, the palletization program was fully implemented by the fall of 1972 at the Philadephia Mint and the majority of the Federal Reserve Banks that it serves. (There are still some Federal Reserve Banks that are not utilizing steel pallets because of building construction limitations.) Under the palletized system, the bagged coins are loaded on steel pallets at the Mint and placed

directly into the carrier with electric or hand trucks (see Figure 4). There is no longer any hand loading of bagged coins. At the Federal Reserve Banks they are unloaded in a similar manner with the pallets being stacked in their vaults (see Figure 5). The next time the coins are handled manually is when the Federal Reserve delivers them to the commercial banks.

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FIGURE 4

LOADED STEEL PALLETS BEING PLACED ON CARRIER BY HAND TRUCK

FOR DELIVERY TO FEDERAL RESERVE BANKS

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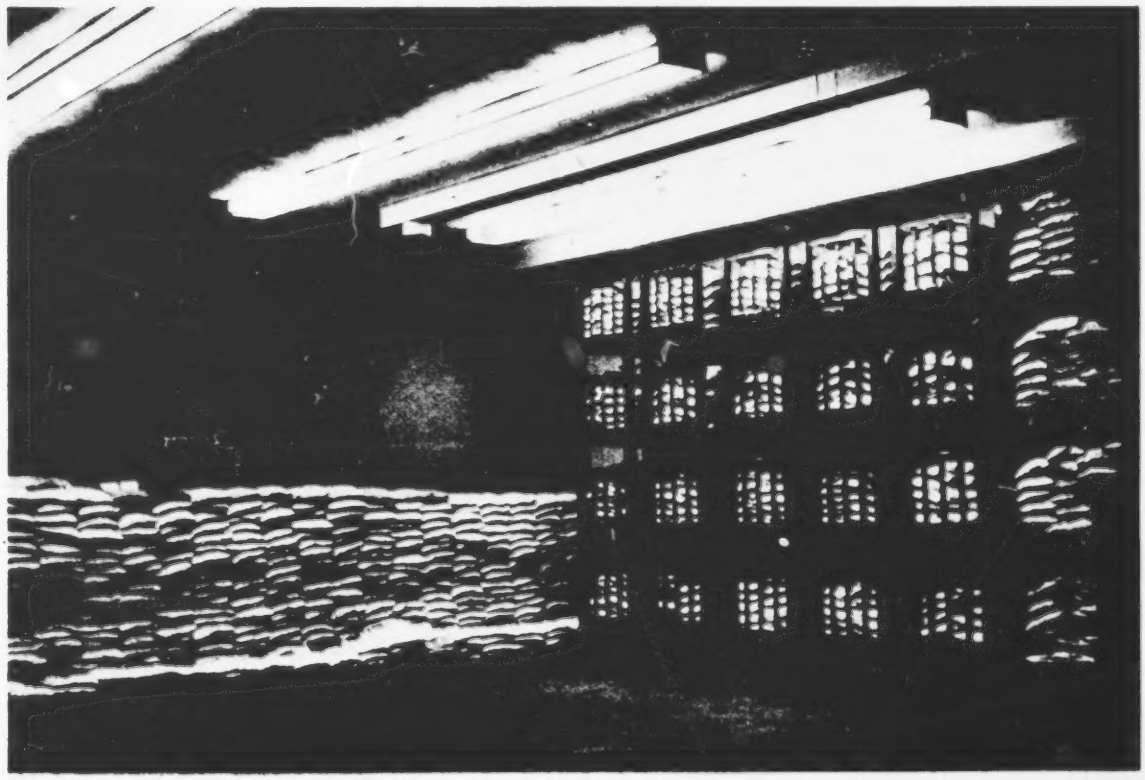
FIGURE 5

INTERIOR OF FEDERAL RESERVE BANK VAULT ILLUSTRATING

OLD AND NEW METHOD OF STORING COINS



Aside from the palletization program, but relevant to the distribution of coins, the Mint requested that the General Services Administration negotiate new tender shipping rates with carriers based on 40,000 pounds minimum shipping weights, instead of the normal 30,000 pound minimum weights. These new rates would apply primarily to shipping pennies and nickels. The GSA was successful in the negotiation and the Mint is currently receiving a minimum of 15 percent reduction in shipping rates.

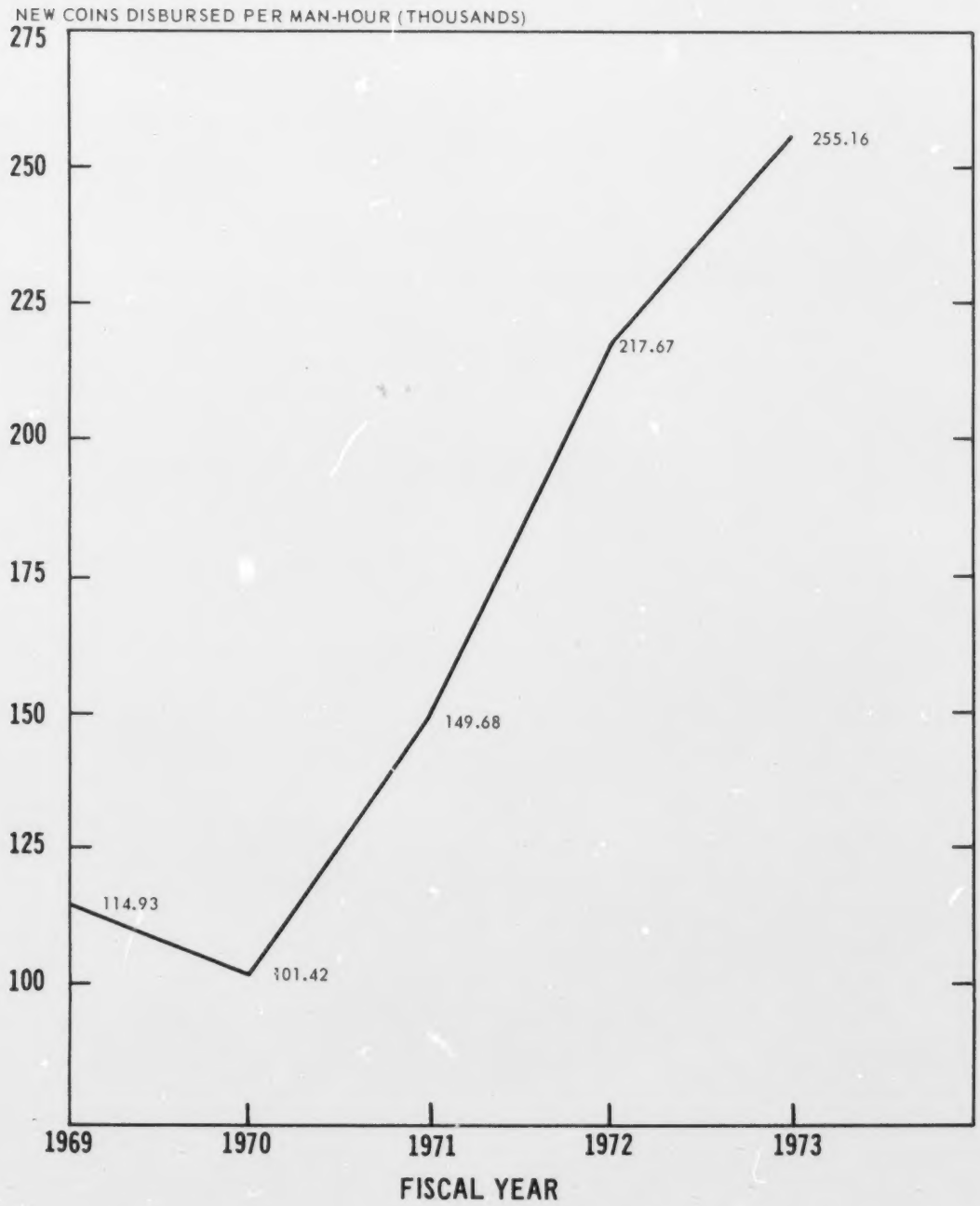
RESULTS

Output Per Manhour and Productivity

Over the past five years the number of coins disbursed per manhour has increased dramatically, as depicted in Chart 1. In 1969 there were 114,930 coins disbursed per manhour (direct and overhead), but by 1973 this measure had risen to 255,160 coins. The drop in output in 1970 to 101,420 coins was attributable to the problems incurred while moving into the new Mint, including the installation of production equipment. The increase in 1971 to 149,680 coins was believed to have been caused primarily by the ease of moving coin within the new Mint, while the large gain to 217,670 coins in 1972 was ascribed to the utilization of steel pallets. The palletization of the total system, from the Philadelphia Mint to the majority of the Federal Reserve Banks, was responsible for the increase in 1973.

CHART 1

NEW COINS DISBURSED PER MAN-HOUR
PHILADELPHIA MINT



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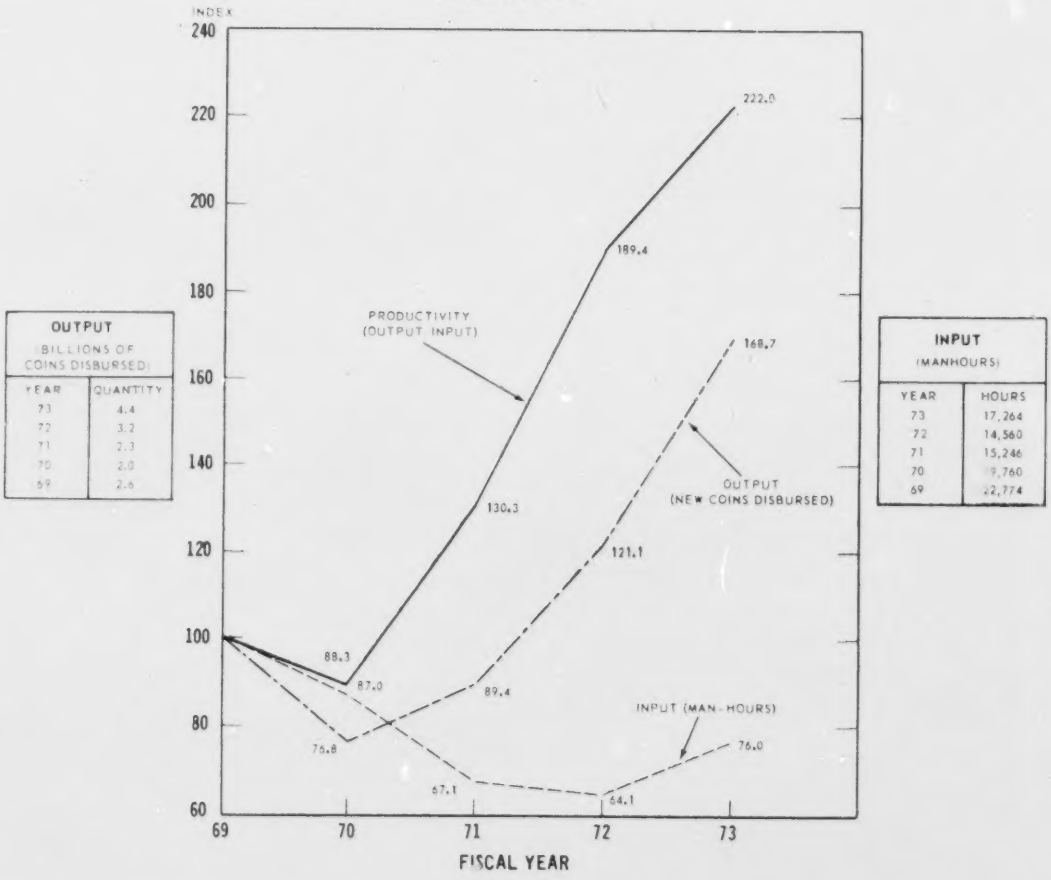
The improvements in productivity are portrayed in Chart 2. There it can be seen that using 1969 as the base year, the output index has increased 68.7 percent while the input index decreased 24 percent for FY 1973. This resulted in a productivity increase of 122 percent. The interpretations used to explain output per manhour are applicable here as well.

CHART 2

PRODUCTIVITY MEASUREMENT OF NEW COINS DISBURSED
PHILADELPHIA MINT



OUTPUT (BILLIONS OF COINS DISBURSED)	
YEAR	QUANTITY
73	4.4
72	3.2
71	2.3
70	2.0
69	2.6

INPUT (MANHOURS)	
YEAR	HOURS
73	17,264
72	14,560
71	15,246
70	19,760
69	22,774

Since space at the Mint has always been at a premium, the use of steel pallets has also greatly enhanced the efficiency of space utilization. When inventory requirements increase at the Philadelphia Mint, as required to support Federal Reserve demand and also for achieving level production scheduling, it will not be necessary to purchase or lease additional space.

As mentioned in the background information, there were significant productivity improvements at the Federal Reserve Banks that are not depicted in Chart 2. However, a report out of the Federal Reserve Subcommittee on Currency and Coin stated that the pallet program "contributes to (the) effective use of storage space, reduces loading and unloading time from 2 to 4 hours to 25 to 30 minutes, facilitates exchanges, and reduces record keeping requirements."

The carriers, of course, were also beneficiaries of the palletization program. Loading and unloading times were reduced to a fraction of those incurred in the movement of unpalletized coins. Only one man will now be required to pick up palletized loads at the Philadephia Mint, and in most cases only one man will be required to deliver the palletized shipments to the Federal Reserve Banks. Losses through mishandling or theft on palletized shipments will also be minimized.

Cost Savings

As mentioned above, aside from the palletization program there were cost savings resulting from the negotiation of shipping rates based on 40,000 pound minimum weights. The implementation of 40,000 pounds per truckload shipments versus the former 30,000 pound shipments, from the three minting facilities, produced a gross savings on transportation cost of about $254,000 for FY 1973, as compared to Fiscal Year 1972. Even with a cost of $110,000 for 2,200 pallets, the net savings for FY 1973 was about $144,000. In succeeding years, however, the outlay for pallets will only be for replacement purposes or for additional pallets in the system, and the actual net saving will be much greater.

Significance of Productivity Accomplishments

The importance of achieving productivity gains in the handling and distribution of coins is that management officials in other areas are beginning to seriously re-evaluate their programs. They realize that a continuous and systematic review of their operation could well mean increases in productivity, and the reduction of program costs in the achievement of their objectives.

Plans and Outlook for the Future

The complete palletization of coin handling and distribution at all coining facilities and Federal Reserve Banks is the ultimate goal of the Mint. Although the construction facilities at the Denver Mint and San Francisco Assay Office are not completely amendable to a palletized program, the Denver Mint is currently participating in the program on a limited scale. Plans are currently being formulated to improve shipping procedures in San Francisco, and to expand the palletized program in Denver.

The implementation of these plans will be reflected in further productivity gains in the overall handling and distribution of coins at the Mint, and the Federal Reserve Banks. The trucking industry will also improve its productivity by cutting labor hours, and in addition will reduce fuel consumption (as a result of 40,000 pound loads) at a time when it is most significant to the Nation.

CHAPTER 11

PRODUCTIVITY THROUGH AUTOMATION IN THE BUREAU OF THE PUBLIC DEBT

INTRODUCTION

The function of the Registered Accounts Branch of the Division of Public Debt Accounts is to establish and maintain accountability of the holdings of registered owners of United States Treasury and designated Agency securities and to supply the proper information to the Washington Disbursing Office for the preparation of interest checks when such interest becomes due and payable.

Prior to July 1970, an addressograph plate system was used to inscribe securities, account cards (maintained by account number), and cross reference file cards (maintained alphabetically) with the owner's name and address. Detail information, such as the security serial number, denomination, and date the account was established, increased, decreased or closed, were hand posted to the account card.

Interest checks were also prepared by the addressograph plate system prior to July 1962. At this time, the responsibility for issuing checks was transferred to the Washington Disbursing Office and a mechanical tabulating punch card system was used to supply the check issue information. This was cumbersome in that one punch card for each line of the inscription and address and one card for the interest amount were needed to produce a check.

In 1968 the Bureau leased a Honeywell 200 computer. Shortly thereafter a system of converting the punch cards to magnetic tape was established. A check issue tape could then be provided to the Disbursing Office.

A Magnetic Tape/Selectric Typewriter (MT/ST) method of inscribing securities, account cards, and cross reference cards was established in July 1970. This also provided an opportunity to improve on the punch card to magnetic tape system. The information on the cassette tape-registered owner's name, interest address, and account number by

SOURCE: Bureau of the Public Debt

loan- was converted to magnetic tape more rapidly and easily. This, however, was not the optimum solution because the principal amount of each account had to be added to or updated on the tape file and interest calculations made at the end of each interest payment period. A check issue tape could then be produced. Another disadvantage of this system was that it did not allow for the account detail information to be maintained. This detail information still had to be hand posted to the individual account cards.

Thus it was recognized that a way was needed to automatically maintain this detail information and to eliminate the costly delays in producing check issue tapes, the excessive number of supplemental checks issued, the time lags in obtaining the information necessary to reply to inquiries, and the slow processing of transactions at interest payment times.

A plan to fully automate the Registered Accounts activities was approved in June 1971. The design, development and implementation of the automated system was a 25 man-year effort. (The system was partially implemented when a decision was made to purchase and install a Univac 1108 computer. This delayed final implementation and required conversion of the programs that had been written as well as some reprogramming.) The new system was declared operational in July 1973. This new system automatically:

a. Establishes and maintains the name, interest address, and detail information of the account of owners of registered securities,

b. Maintains a numerical record of each registered security printed,

c. Provides a complete history of each account for inquiry purposes,

d. Uses the owner's taxpayer identification number as the account number,

e. Reduces the account upon notification of a retirement transaction by the Bureau or its agents.

f. Authorizes the issuance and release of interest checks,

g. Provides for the issuance and release of statements of the amount of interest paid on each account to registered owners and preparation of a tape to report to the Internal Revenue Service the amount of interest paid on each account,

h. Maintains deposit fund accounts for undeliverable interest checks,

i. Balances account totals, loan totals, and check issuance certification totals with the public debt outstanding totals, and

j. Provides labels for use in the mailing of refinancing notices to registered owners.

ACCOMPLISHMENTS

As a result of the automation project, the manpower requirements of the Registered Accounts Branch increased from a pre-conversion figure of 79 in FY 1971, to 85 in FY 1972, and to 91 in FY 1973. These extra positions were needed to process the additional workload resulting from the conversion efforts. In addition, 11 manyears in FY 1972 and 14 manyears in FY 1973 were spent on the design, development, and implementation of the new system. However, by February 1974, eight months after the systems was implemented, the Branch's manpower had decreased to 63 positions and manpower is expected to continue to decrease as refinements are made to the system. In addition, approximately 8 manyears annually are spent on maintenance of the system.

Because of an increase in responsibilities and elimination of the repetitive manual tasks, the Branch's overall grade structure was raised. Whereas in FY 1971, 74 percent of the employees were GS-4 or below, by the end of FY 1974 it is expected that only 50 percent will be below this level.

An improvement in service can also be noted due to the conversion. In FY 1971, the Branch processed 156,253 service items. These items include such things as requests for providing information on accounts to registered owners, placement of stoppages on non-received interest checks, remailing returned checks, changes of address, etc. The number of service items processed in FY 1974, as of February, decreased to 39,933. The most significant change occurred in the number

of interest checks returned which had to be remailed. In FY 1971, of the 2,277 checks returned, 42 percent had to be remailed. As of February, in FY 1974, only 1,091 checks were returned and only 21 percent had to be remailed. The decrease can be attributed to the automated system for two reasons: (1) addresses are changed more quickly and accurately, and (2) interest checks against which a "hold" (for example, a prior check was returned for "Better Address" and mailing instructions have not been received) has been placed are not issued. Prior to the conversion, a check against which a "hold" had been placed was issued and returned to the Bureau by the Disbursing Office. A voucher listing all checks returned then had to be prepared and each check negotiated in order to make deposit to a special holding account. Now, a voucher showing only the amount of deposit is prepared and the detail information is automatically maintained.

The measurement of productivity is related to the number of securities issued, retired and serviced. This volume of securities issued, however, is not controllable and any changes cannot be attributed to the conversion. The volume is dictated by the security offerings of the Treasury which are dictated by market conditions, the need for additional funds and other economic factors. For example, when interest rates are high, large numbers of investors are attracted. This in turn has a substantial impact on the Branch's workload.

Workload volume declined during the conversion period evidenced by the following table.

WORKLOAD CHANGES

Year	Accounts outstanding	Interest checks issued	Accounts opened	Accounts closed
1971	295,379	528,798	99,033	65,340
1972	275,944	508,188	50,588	76,209
1973	262,938	443,969	37,015	50,220

FY 1974 figures, however, indicated that the volume is again rising. As of February 1974, there were 272,259 outstanding accounts and this figure is expected to reach about 300,000. A similar rise is projected in the number of checks issued (440,000) and accounts opened (72,000). The number of accounts closed is expected to decline to 48,500.

Finally, in conjunction with the implementation of the automated system, a reorganization of the Branch took place. This brought the responsibilities of each employee and working unit into focus with the system.

Conclusion

The implementation of an automated system to maintain accounts of registered securities and the resulting reorganization of the Registered Accounts Branch provides the Bureau greater accuracy and timeliness in distributing interest to security holders and reconciling its public debt outstanding accounts. It also provides a stable operating environment in that processing of the work will not be greatly impacted by fluctuations in the sale of registered securities. The Bureau was also able to eliminate many low level clerical positions and to raise the skill and interest level of others. Employees under the old system were cross trained for these higher level positions.

CHAPTER 12

IMPROVED MEASUREMENT OF PRODUCTIVITY IN POWER OPERATIONS OF THE TENNESSEE VALLEY AUTHORITY

The Tennessee Valley Authority (TVA) produces and sells electric power to 160 municipal and cooperative systems for service to 2.3 million customers. Direct service is also provided to 48 industries and 10 Federal installations.

The TVA system includes 29 dams built or acquired by TVA, 12 steam plants, and 2 gas turbine installations. In addition, power produced at 8 Corps of Engineers dams and 12 dams owned by The Aluminum Company of America is available through the TVA system. The total installed capacity is about 22,000 megawatts. TVA power is transmitted through a system consisting of more than 600 substations and over 16,000 miles of line.

BACKGROUND

As a part of its existing management information reporting system, TVA regularly evaluates data on unit costs and labor productivity for its power operations. Unit operating costs are tabulated monthly for each power plant in the TVA system and reported in the Monthly Report of the Division of Power Production. System costs are analyzed on a unit basis as a part of the quarterly financial review. Aggregate labor productivity is reviewed on an annual basis in conjunction with the financial analysis procedure.

The analysis of unit cost and productivity data is an integral part of the management of TVA power operations. However, TVA has identified a need for a more integrated approach to the analysis and reporting of such information. The Joint Financial Management Improvement Program staff has been working with TVA in the design of such an integrated reporting and analysis system.

SOURCE: Joint Effort - TVA and JFMIP Task Force

TVA is currently participating in the Federal productivity project. The submission covers the entire agency of over 24,000 FY 1973 man-years incorporating 38 outputs. Power operations utilized 7,605 man-years in FY 1973 in three major areas: (1) power production (4,667); (2) power transmission (951); and (3) administrative and support activities (1,987).

MEASUREMENT OF LABOR PRODUCTIVITY

Labor productivity in TVA power operations may be generally measured in terms of net kWh per employee although in certain cases of detailed analysis other output measures may also be appropriate. For example, operation and maintenance of transmission lines may be measured in terms of number of miles of line of specified voltages. While TVA has monitored labor productivity at the aggregate level for some time, it has not developed a systematic capability for analysis of labor productivity at a detailed level. Detailed analysis for power operations has been conducted largely in unit cost terms (mills per kWh sold). As the power operations have increased in complexity, there has been a growing need for detailed labor productivity data to complement the existing detailed unit cost information.

Working with the JFMIP staff, TVA undertook a prototype of a detailed labor productivity measurement and reporting system which had the capability to generate annual labor productivity measures for each producing power plant, several categories of transmission facilities, and administrative and general activities. A description of the concept and partial productivity results are discussed below.

PRODUCTIVITY MEASUREMENT CONCEPT

The productivity model is designed to be flexible and is customized to TVA-power operations managerial style. The model is predicated on several design principles, namely: (1) a predefined structure of productivity data between the total resource component and lowest functional activity at the plant level, (2) an ability to generate selected data associated with productivity measures such as weights and current and constant dollar unit labor costs, (3) a basic element measurement in terms of itself to a reference period, (4) an ability to identify the impact of the input element contributing to the result, and (5) a top down generation of information modules.

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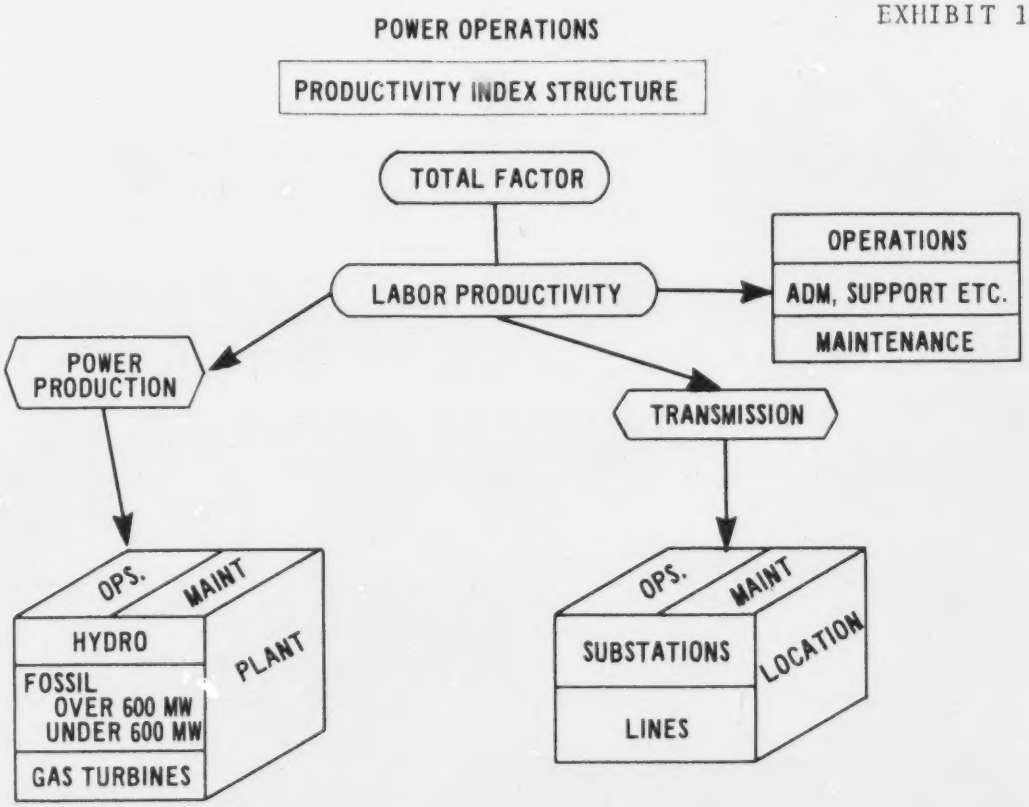
The type of information furnished by the model is basic such as (1) magnitudes of inputs and output for each output measure, (2) rate of productivity, i.e., power generated per man-year of input by location, (3) trend of period productivity, and (4) payoff, i.e., cost of the impact of productivity change in terms of the input measure.

Analytical Structure--A diagram showing the analytical structure for the measurement of productivity in power operations is shown in Exhibit #1. The data generated begins with a total factor index. This index takes in account all resources spent to produce the output. The output measure is the physical amount of energy sold expressed in kilowatt hours. The next level consists of a partial analysis of a given input element. The lowest level is by work function and by type of activity. For example, power production is the total electricity generated at TVA plants. Accessability of productivity data can be from any one of three dimensions, namely: (1) by type of plant, (2) by plant location, and (3) by type of work.

EXHIBIT 1



Analysis of Total Factor Productivity--Partial measures of productivity, such as labor productivity, are difficult to interpret in the absence of some measure of the contribution of other factors in the production process. In the case of TVA power operations, capital is an important concern of management, as is the utilization of purchased inputs. Because of these concerns, the prototype system was designed for an analysis of total resource utilization.

The analysis of total factor productivity has been confined to the aggregate level pending evaluation of the many measurement problems associated with such a study. Current efforts are being directed towards the evaluation of measurement problems and the assessment of potential uses in light of these problems. The JFMIP staff will continue to work with TVA in the investigation of these areas as appropriate during this evaluation period.

MEASUREMENT PROBLEMS

The prototype study indicated that overall labor productivity in power operations increased at an average annual rate of 0.3 percent between FY 1969 and FY 1973. TVA indicates that productivity increases were limited during this period because of delays encountered in the completion of new power generating units. Labor productivity should improve markedly as these units come on line. The most recent year (1973) showed a productivity gain of 9.3 percent. This high productivity was achieved by substantial output increase of 13.1 percent accompanied by an input increase of only 3.4 percent.

Production Element--Measurement of labor productivity in the generating element is extremely complex. Ideally, the system should permit focusing or raising questions on individual plant productivity through a matrix of maintenance and operations productivity. Each plant has a labor force consisting of two types of labor: operations (those who operate the plant); and maintenance (those who maintain the equipment). Exhibit #2 shows the relationship of each hydro plant's productivity in terms of these components.

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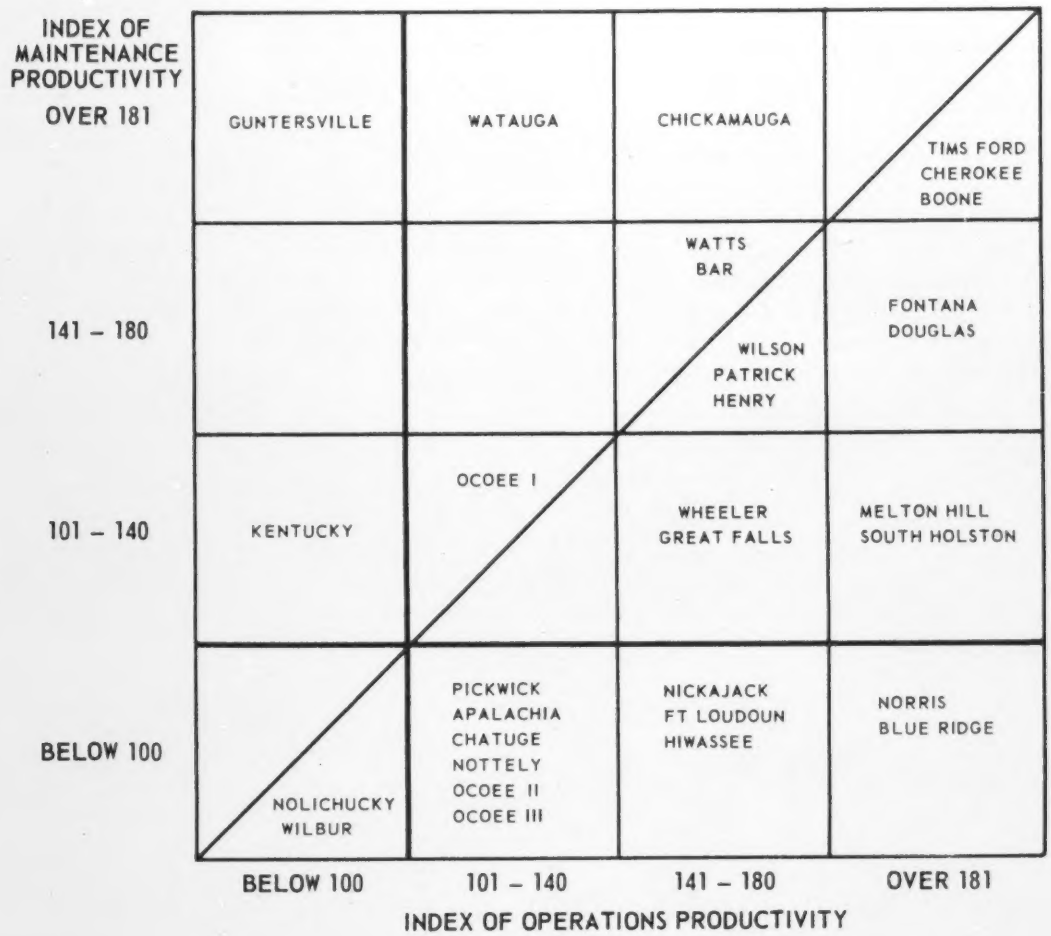
EXHIBIT 2

RELATIONSHIP BETWEEN OPERATIONS AND MAINTENANCE FY 1973 PRODUCTIVITY BY PLANT (FY 1969 – 1973)



Unfortunately, changes in labor productivity in the generating element are extremely sensitive to changes in capacity utilization as indicated in Exhibit #3. Capacity utilization in turn depends upon a number of factors which are not stable on a year-to-year basis: (1) temperature condition; (2) rainfall; (3) age of plant; (4) unscheduled maintenance; (5) environmental constraints on operations; and (6) customer growth. Comparisons of changes over time are complicated by the need to evaluate the effects of these conditions in both the base year and the year under analysis.

EXHIBIT 3

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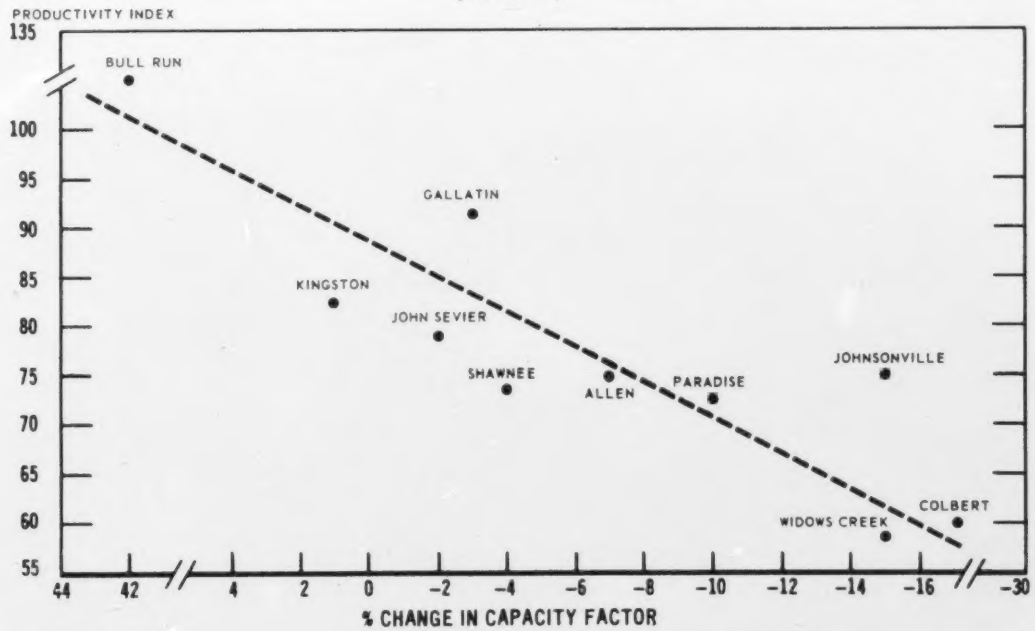
RELATIONSHIP BETWEEN PRODUCTIVITY
AND CAPACITY FACTOR FOR FOSSIL PLANTS
(FY 69 – 73)



Transmission Element--The transmission element of power operations is less sensitive to year-to-year changes and showed a four-year productivity gain of 24.2 percent. A review of the component indexes shows that substations which increased in productivity by 34 percent during the same period contributed to high overall productivity. A table showing the trend values of input, output, and productivity for transmission components is shown in Exhibit #4.

EXHIBIT 4

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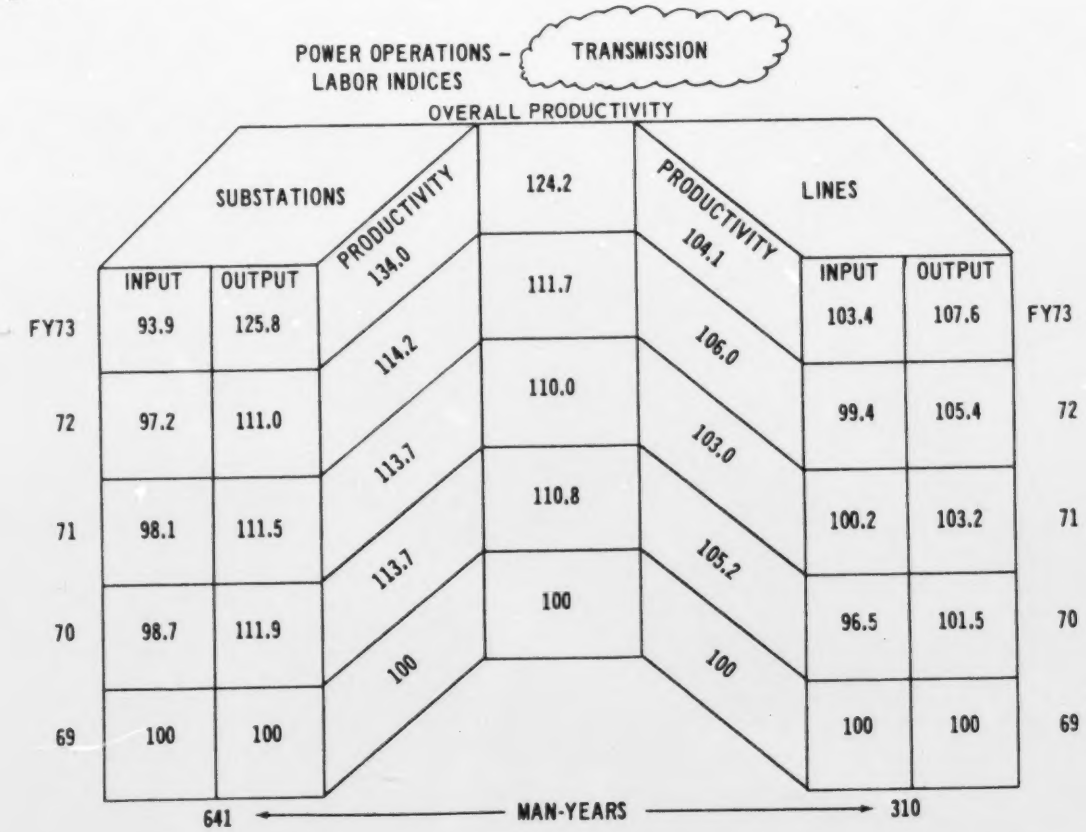

NEXT STEP FOR IMPROVEMENT

Following a TVA staff evaluation of the prototype study discussed in this report, it was decided to implement the system on a continuing basis utilizing monthly data generated from payroll records. This data improvement will greatly increase the reliability of individual plant analyses.

The development of computer software necessary to the operation of this system is currently being undertaken by TVA. As presently visualized, formal reports for management would be generated on a quarterly basis. Special and ad hoc reports would be able to utilize monthly data current through the month previous to the analysis.

CHAPTER 13

PRODUCTIVITY MEASUREMENT AND QUALITY EVALUATION IN THE SOCIAL SECURITY ADMINISTRATION, DHEW

INTRODUCTION

For many years, the Social Security Administration (SSA) has used productivity measurement as part of its management process. The agency has, in addition, strongly supported and actively participated in the Government-wide effort to measure and improve productivity, beginning with the initial study conducted during fiscal years 1971-1973 by the Office of Management and Budget, the General Accounting Office, and the Civil Service Commission.

SSA is charged with carrying out the Retirement and Survivors Insurance, Disability Insurance, and Health Insurance (Medicare) programs, as well as a recently enacted Supplemental Security Income program for the aged, blind and disabled. In June 1974, the agency has over 71,000 full-time permanent employees located in offices throughout the United States. In addition to the functions performed by these employees, important functions in the administration of Medicare and the disability insurance and supplemental security programs are performed under contract by insurance companies and State agencies.

SSA served about 30 million retirement, survivors, and disability insurance beneficiaries in FY 1973. There were also about 20 million persons protected by the health insurance program during that period. The agency processes high workload volumes, largely generated by the public and influenced by economic and demographic factors and the specific provisions of the Social Security Act. For example, in FY 1973 the agency processed 3.9 million claims for retirement and survivors insurance benefits, 1.5 million claims for disability insurance benefits and 79 million claims for payment for medical services; issued 11 million social security numbers; and posted 348 million items to update the earnings records of individuals covered by social security.

SOURCE: Social Security Administration

PRODUCTIVITY MEASUREMENT AND EXPERIENCE IN THE SOCIAL SECURITY ADMINISTRATION

SSA measures productivity by counting and weighting, by their respective manpower requirements, each of the outputs of the agency and relating the result to the total manpower input of the agency. The outputs represent principal indicators of the volume of work handled by the agency to carry out its missions. Largely, they fall within four major functional categories common to all programs administered by the SSA: (1) initial enrollment for benefits; (2) appellate processes with respect to initial and subsequent claims decisions; (3) keeping the beneficiary rolls up to data and paying benefits, and (4) carrying out all provisions of law relating to continuing eligibility for benefits. In the annual budget presentations to the Congress, productivity experience for the past ten years is shown. The FY 1975 appropriation request for expenses of administering SSA's principal programs included the data shown in the enclosed chart, Exhibit A.

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EXHIBIT A

COMPARISON OF MANPOWER WITH WORKLOAD[1]
PRODUCTIVITY INDEX
Fiscal Year 1965 = 100

INDICES OF WORK OUTPUT, MANPOWER, AND PRODUCTIVITY

Year	Work Output	Manpower	Productivity [2]
1965 actual	100.00	100.00	100.00
1966 actual	144.78	137.15	105.56
1967 actual	167.26	140.48	119.06
1968 actual	189.61	154.97	122.35
1969 actual	197.49	153.94	128.29
1970 actual	208.53	151.80	137.37
1971 actual	220.67	156.86	140.68
1972 actual	228.28	159.71	142.93
1973 actual	252.41	168.48	149.82
1974 estimate	343.68	220.20	156.08
1975 estimate	373.27	220.64	169.18

[1] Work performed by State agencies and Medicare contractors and the manpower for them are excluded.
[2] Productivity index equals work output index divided by manpower index times 100.

The gap between the output index and the manpower index indicates manpower savings. This analysis means that in FY 1973 the agency used less than 60,000 manyears to administer these programs instead of the over 89,000 manyears that would have been required at FY 1965 production rates, a saving of about 30,000 manyears in the eight-year period.

EXHIBIT B

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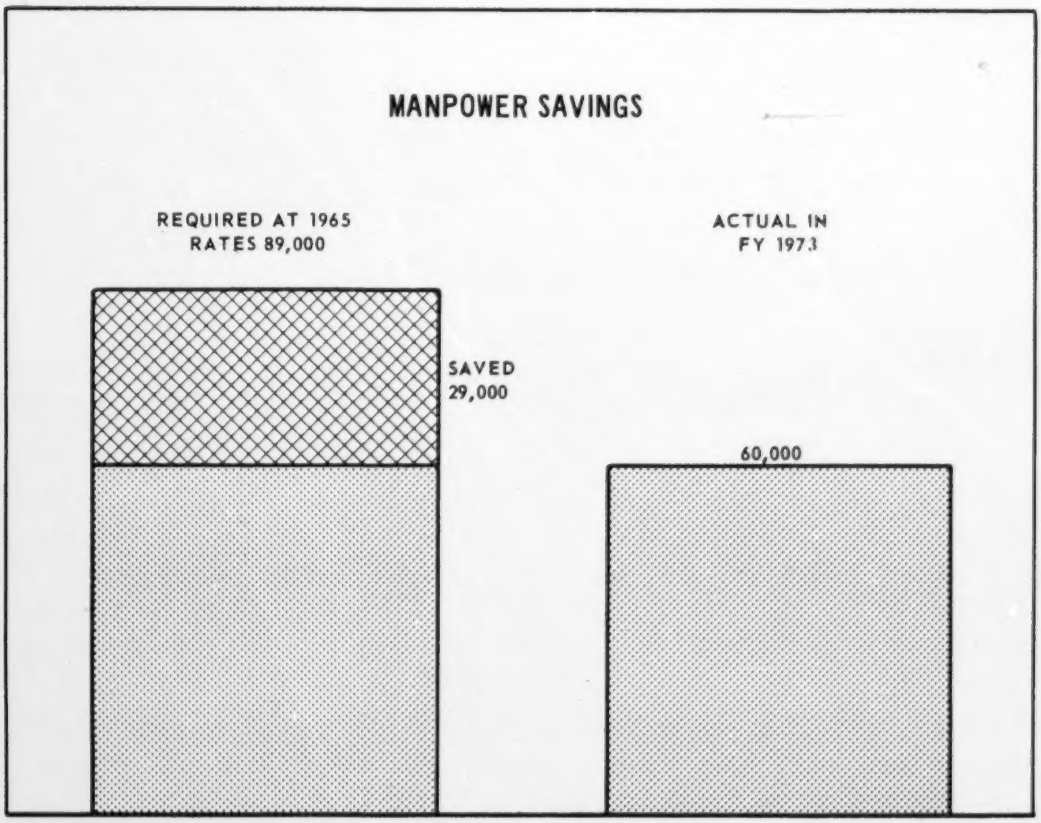


REFLECTION OF QUALITATIVE CHANGES IN PRODUCTIVITY MEASURES

The treatment of qualitative changes is one of the most difficult problems in productivity measurement. In contrast to most segments of the private sector of the economy in which a change in the level of quality can be reflected in prices, Federal agencies have no price structure for their services. When Federal agencies recognize that their service is not what it should be, a decision may be made to expend more resources to improve that quality. The result is that given outputs of the agency will require more manpower per unit than in the past. It is important not to penalize agencies by having these decisions to improve quality reflected in the productivity measure as a decline in efficiency. A somewhat comparable problem is encountered when an agency's workloads contain component workloads which require varying amounts of manpower per unit to process. If the total workload volume remains unchanged, but there is an increasing ratio of the workload component which requires the greater amount of manpower per unit, it is important not to reflect this change in "workload mix" in the agency's productivity.

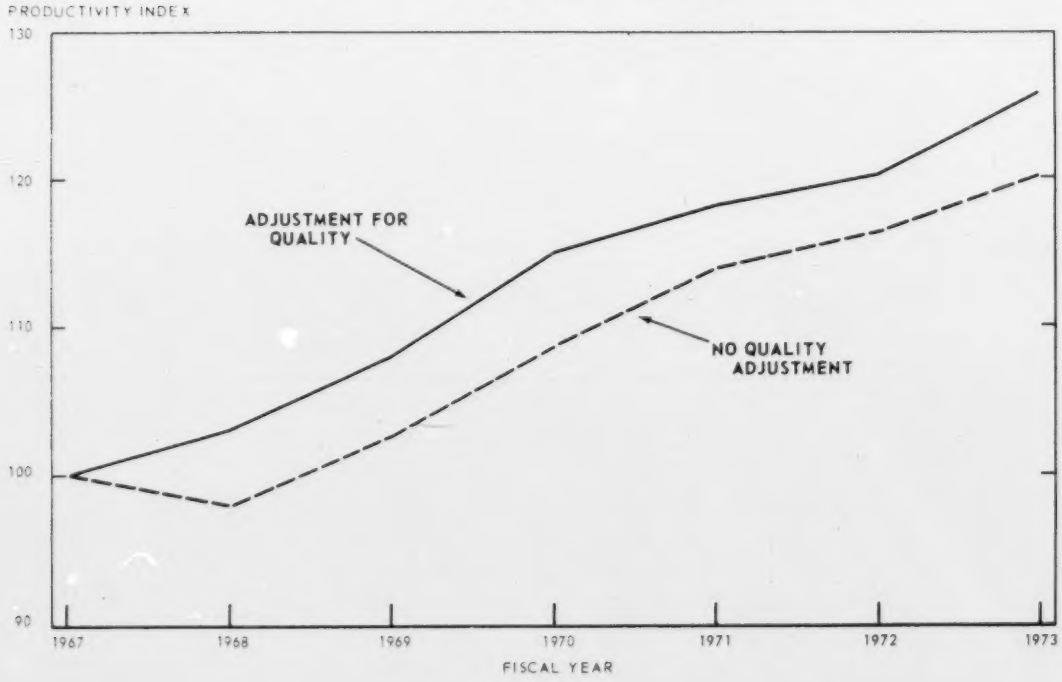
SSA adjusts for qualitative and workload mix changes in its productivity measures. Essentially, this is done by computing the effect of workload mix changes on manpower requirements and the amount of manpower required to carry out measures to improve quality, and incorporating that manpower in the output index, as well as in the input index. Quantitative adjustments for quality have not been generally made in the Bureau of Labor Statistics (BLS) in computing agency indexes. However, steps are being taken to reflect changes in quality and workload mix in the productivity measure.

In 1968 the productivity index for SSA as measured by BLS shows a decline. During that year SSA devoted a considerable amount of manpower to installing a case control system to help the agency become more responsive to the public in responding to inquiries and in processing actions more timely. This, plus other qualitative improvements and changes in the workload mix, cost about 1,100 manyears. Incorporating that manpower into work output as well as manpower input, as is done under Social Security's method of computation, would not have produced that decline in the productivity index.

Exhibit C shows the productivity indices for the SSA for FY 1967-1973 under both the method of computation used by BLS and that used by SSA. While there are other differences in the methodologies used, the main differences in the two sets of indexes arise because the SSA includes workload mix changes and measures to improve quality in its productivity measures.

EXHIBIT C

COMPARISON OF PRODUCTIVITY INDEX
WITH AND WITHOUT ADJUSTMENT FOR QUALITY



PRODUCTIVITY MANAGEMENT IN THE SOCIAL SECURITY ADMINISTRATION

It is recognized that productivity measurement is not done for its own sake. Productivity measurement is one of the better tools for overall evaluation of an organization's efficiency over a period of time. As an overall indicator, it can show management whether its total efficiency objectives are being met.

A conscientious effort is made within SSA to improve productivity. Productivity measurement is one of the prime tools used in reaching decisions in the budget process within the agency and by those organizations that review the agency's budget requests. Since productivity is only a gross measure of organizational efficiency, a detailed analysis is required each year to determine what steps can be taken to improve productivity. The principal data source for this analysis is the agency's work measurement systems.

About ninety percent of the manpower of SSA is covered by work measurement systems. These tell management the number of work units handled, the amount of time spent per unit of work, and the grade level of employees engaged in processing the various workloads of the agency. Because the agency has so many employees who are involved in processing several different types of workloads for several programs in a given day, these work measurement systems are necessary to sort out the input of time by workloads and by programs. These systems provide a basis for analyzing productivity changes that occurred in the past and computing changes in future years.

Each year, as part of the budget development cycle, the workloads for the agency are projected and an assessment is made of the major changes planned in the systems and procedures which will affect workload processing. The production rates for each workload are analyzed to determine why productivity changed in the past and what should occur in the future. These changes in production rates are classified according to those instituted to gain efficiency and those instituted to improve the quality of the work. Manpower used for supervision, support, training, travel, and similar indirect production categories undergoes similar analysis. The net effect of these changes on overall agency productivity is evaluated. When the level of productivity improvement is

not considered satisfactory, a reevaluation is made to determine where further productivity improvement might be achieved.

A continuing analysis of productivity is performed as a part of the budget execution process. Reprogramming of resources is sometimes necessary if projected improvements in productivity do not occur because systems changes do not take place as scheduled, if legislation alters the way work is performed or, conversely, if unbudgeted improvements in productivity do occur for a variety of reasons.

The major productivity improvements come from increased application of automatic data processing techniques to work processes. Those applications may involve using automatic data processing for work done heretofore on a manual basis or improving the integration and systems capability of a work process that is already automated. Other productivity improvements may come from procedural changes. One example of a procedural change in FY 1973 was the decision to encourage claimants and beneficiaries to contact the agency's district offices by telephone, rather than visiting the office; this also provided greater convenience to the public. (Exhibit D)

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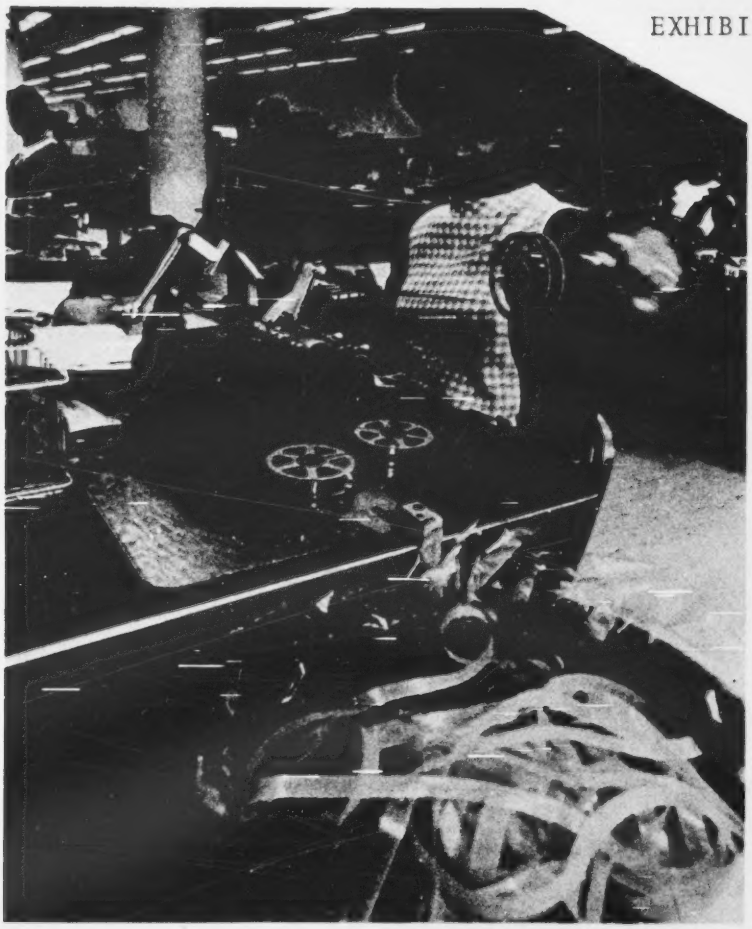
EXHIBIT D

BILLBOARD IN AKRON, OHIO ENCOURAGING PEOPLE TO PHONE RATHER THAN VISIT THEIR SOCIAL SECURITY OFFICE.

Another example is the elimination of review of the work of the claims ajudicator in the district offices of less error-prone retirement and survivors insurance claims. Another way Social Security improved its productivity is through working with large companies to receive employee earnings information in automated form, rather than hard copy form. A comparable effort is underway with the health insurance contractors, many of which now submit individual health insurance claims on magnetic tape, rather than in hard copy form. In addition, extensive use of microfilm has conserved space in work areas and resulted in quicker access. (Exhibit E)

EXHIBIT E



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EMPLOYEE IN BUREAU OF DATA PROCESSING SPLICES MICROFILM. EXTENSIVE USE OF MICROFILM CONSERVES SPACE AND PERMITS QUICK ACCESS TO INFORMATION.

While increased use of automatic data processing and procedural changes will likely continue to be the major sources of productivity improvement, the opportunity to achieve better organizational performance through improved employee performance is not being overlooked. There are many instances of well-documented studies in the private sector of the economy in which improved productivity and quality of operations have been achieved through improved management practices, such as job enrichment and team building. SSA has undertaken just recently several major studies designed to test these practices in the Federal agency environment. The studies are intended to produce quantified measures of the effects of these types of behavioral management on productivity and quality.

QUALITY MEASURES OF PERFORMANCE IN THE SOCIAL SECURITY ADMINISTRATION

Productivity measurement is only one of several measures that should be used in evaluating an organization's total performance. Another measure frequently referred to in conjunction with productivity measurement is quality measurement. If productivity improvement is realized at the cost of deterioration in the quality of the service rendered, then the public is not being well served. Because the quality of the performance of SSA has a serious impact on the lives of individuals covered by social security, the agency is very mindful of the need to provide a high level of service to social security claimants and beneficiaries.

Often, measures taken to improve productivity also improve quality. For example, increasing the use of automatic data processing generally leads to productivity improvement, but by permitting an agency to handle a greater volume of work with a given level of resources and time, the elapsed processing time is shortened considerably. The increasing use of telephone communications to deal with the agency's claimants and beneficiaries not only results in manpower savings but also relieves the public of the need to actually visit the social security district office.

SSA has several ongoing systems designed to measure in a quantified manner the quality level of its performance. Two basic systems monitor the quality of the Retirement and Survivors Insurance and the Disability Insurance programs. These two systems are fairly comparable, and the former system is briefly described below. A similar quality appraisal system will be established for the Supplemental Security Income program for the aged, blind, and disabled. While a major portion of actual operations of the Health Insurance program is carried out by contractors, SSA does monitor the quality of those operations through analyses of prices paid for comparable medical services and through other measures.

The basic objective of SSA's quality appraisal system for the Retirement and Survivors Insurance program operations are: (1) to provide management with overview information on the accuracy and the processing times of that operation and (2) to improve the quality of the operation by providing information by processing station on the types of

errors and deficiencies noted. The system randomly selects a statistically valid sample of various types of claims and actions at the termination of their processing. These claims and actions are independently reviewed and data are gathered on the types of errors detected and on processing times. Errors are classified as payment related or procedural. Detected errors are corrected and continuous reports and trend analyses are produced. Specific types of problems may be identified and subjected to more rigorous analyses. The managers of the various processing stations are periodically visited to discuss the quality of their performance.

Among the types of measures of quality performance gathered in this system are: (1) the percentage of initial claims and of subsequent beneficiary actions processed free of payment related errors and the percentage free of procedural errors; (2) data on the types of errors being made; (3) the average processing time in total and by major processing locations for claims and subsequent beneficiary actions; and (4) the number of beneficiary actions that are received and processed in time to prevent disruption of payment.

A review of the recent trends of these various measures of quality shows a mixed pattern: improvement in some of the measures, no major trends in other measures, and deterioration in the trends of still other measures. This contrasts with the strong continuous trend of productivity improvement for SSA noted previously. This relationship exemplifies one of the concerns of SSA and of other Federal managers, namely, that the strong emphasis placed on achieving a high rate of productivity improvement must be counterbalanced with concern for quality of operations. The essential point, however, is that managers must have measurement systems for both productivity and quality; operations managers and review authorities must assess the impact that resource allocation decisions will have on these and other measures of organizational performance.

Two other measurement systems operate in SSA which help the agency monitor its performance. One of these systems, the Evaluation and Measurement System, is used to validate the policies and procedures followed by employees in processing claims and beneficiary actions, to ascertain whether the policies and procedures are appropriate to meet the requirements of the Social Security Act, and to insure that policies

and procedures are properly carried out by agency employees. The Evaluation and Measurement System selects a random number of cases for study. Claims and actions are completely redeveloped by employees not previously associated with the prior action. Claimants or beneficiaries are recontacted and a rigorous field investigation is conducted. Additional documentation is sought to further evaluate documentation submitted with the claim or action. The data and decisions from the initial action and those from the revalidation are electronically stored and analysis is produced on a periodic basis. When there are indications of weaknesses in policies and procedures or in employee adherence to those policies and procedures, further analyses are undertaken and, if appropriate, policy or procedural changes are made.

The second quality measurement system, the Quality of Service Measurement System, is now being developed by SSA. This system will provide for direct, independent contact with members of the public who have had recent dealings with the agency. Those members of the public will be asked to respond to questions on the quality of service they felt they received from Social Security, including matters of courtesy, timeliness of action, explanations of rights and responsibilities, and other indicators of the level of service.

Improving and measuring quality is a complex issue where legislative changes are frequent and in which many systems and procedural modifications are underway at any given point of time. A direct relationship between a specific system and procedural change and its effect on a specific quality measure is often virtually impossible to discern. Another problem occurs in tracking quality measures over time. Because of legislative, policy, and systems changes, the nature of a claim or beneficiary action in 1973 may not be the same as it was in 1970.

One other point should be made: the quality measurement systems discussed relate to the quality of operational performance but not to program effectiveness. Program effectiveness for SSA must assess how adequately its programs are replacing, at a desirable level, income lost through retirement, death, and disability and how well the health costs of the aged are being covered by social security health insurance. This type of program effectiveness measurement for SSA is made through a continuing research and statistical analysis activity.

CONCLUSION

The major conclusions of SSA on matters of productivity measurement, quality measurement, and their interrelationships are as follows: (1) SSA strongly supports the efforts to more fully utilize productivity measurement at all levels in the Federal Government; (2) it is important for the Federal Government to pursue the matter of quality measurement; (3) quality measurement systems must be adapted to each individual agency's unique situation; (4) productivity measurement, quality measurement and other performance measures must be used jointly in evaluating an organization's performance and in determining resource allocation for the agency; and (5) ongoing, quantified measurement systems' data seldom stand on their own, since they are generally only gross indicators which must be supported by more detailed analyses and explanations. The Social Security Administration places a high priority on the type of information produced from these performance evaluation systems and recognizes the significance of such information in reaching management decisions.

CHAPTER 14

PRODUCTIVITY IMPROVEMENT IN

CLERICAL FUNCTION OF THE VETERANS ADMINISTRATION

The Department of Veterans Benefits of the Veterans Administration is responsible for the administration of various financial assistance programs provided by law for veterans, their dependents and beneficiaries. The most significant of these financial assistance benefits programs are compensation, pension, educational assistance, loan guaranty and life insurance. Under the direction of this Department, a nationwide network of 58 field stations administers this program of benefits and services and provides related services for other Federal agencies, allied governments and miscellaneous beneficiaries within the limitation of established policies and delegated authority.

Because of the size of the veterans population, the scope of benefits administered and the impossibility of conducting a face-to-face business with the majority of those served, a high volume correspondence operation is essential to the effective fulfillment of the Department's responsibilities. It is imperative, therefore, to provide a high volume correspondence operation of high quality and to provide for its creation in an economical, efficient and timely manner. This has become increasingly difficult because of mounting correspondence workloads, coupled with the rising cost of people, tools and other ingredients essential to the production of correspondence without a concomitant increase in personnel ceilings and funds. Adding significantly to the problem has been the acknowledged fact that increased individual productivity has not kept pace with spiraling costs as the erosion of the competitive recruitment position of the VA has forced acceptance of less productive clerical personnel.

To meet this challenge, it was necessary to restructure the Department's correspondence operation to first take advantage of the benefit of systematic production methods and then to capitalize on the best tools available at the marketplace.

SOURCE: Veterans Administration

Through long years of development, it had been determined that the organization of correspondence output operations into word processing centers known as Centralized Transcription Activities provided the most efficient vehicle for accomplishing high level correspondence production. Therefore the department has concentrated on expanding the number of stationwide Centralized Transcription Activities in field stations. Today, 48 out of 58 stations have fully operational Centralized Transcription Activities equipped with centralized dictating systems. All of the recently equipped ones are provided with full integrated continuous flow dictation systems which are the most efficient on the market. As additional funds become available, it is planned to install Centralized Transcription Activities in eight of the ten remaining field stations and to replace existing obsolete dictation systems with the more sophisticated continuous flow systems.

The results of installation of new Centralized Transcription Activities have been to significantly increase production and to substantially reduce operating costs. It concentrates the preparation of all types of correspondence into one unit for the entire station. This assembly line/ production line type of correspondence operation has raised capability and reduced manpower requirements by the average of a combined 25 percent at field stations where installed. At the same time, it improves the quality and timeliness of correspondence operations and provides greater flexibility in manpower utilization.

The next step was to take advantage of the best tools available at the marketplace for high volume correspondence production. In 1968, a DVB study in the application of automatic typewriters for the preparation of repetitive and prestigetype correspondence in field station Centralized Transcription Activities was accomplished. The results of the test proved that the use of high speed automatic typewriters for the preparation of these types of correspondence could contribute significantly toward alleviating correspondence backlogs, recruitment problems associated with high turnover in the competitive clerical field and personnel ceilings limitations. The study results also established that automatic typewriters could outperform standard typewriters by two to one in these applications and that a transcriber could produce at least 100 percent more per day than the production rate on a standard electric typewriter.

Based on the generally accepted standard of 500 lines production per day on a standard electric typewriter, the conclusion was reached that it was reasonable to expect production of 1,100 to 1,200 lines per day on an automatic typewriter. This would pay the extra costs of leasing automated equipment and permit the reduction of at an average of one fulltime clerical/typing position for each automatic typewriter installed. Based on these favorable results, 80 automatic typewriters have since been installed on a lease basis in 48 stations. The results have fulfilled the expectations. Several stations are now surpassing the line production standards established from the study. (See Exhibit A).

Until the past year, it has been considered impractical to purchase automatic typewriters due to limitations in the state of the art and the high cost of acquisition. This now is rapidly being overcome by a proliferation of automatic typewriters on the market with varying modes and numerous features not previously attainable.

In November 1970, an 8 month study was conducted to determine if total utilization of automatic typewriters for across-the-board preparation of correspondence (power typing) in field station Centralized Transcription Activities would result in even greater increased productivity. Based on the overall evaluation of the findings during the study, it was concluded that total utilization of automatic typewriters as compared to standard electric typewriters did not significantly increase productivity. Increases realized were not sufficient overall to provide a cost savings. However, the results did prove that automatic typewriters can be effectively and economically utilized for power typing of nonrepetitive correspondence when software support is devised to assure continued high level production. Selection of operators, training and controlled operation are all essential to the achievement of the desired results. The advent of the lower cost automatic typewriters and the companion corrective selectric typewriters with memory units has further enhanced the savings to be realized from utilization of this further automation of the operation. Full implementation of the power typing concept is now being programmed.

Since 1965, $541,306 has been expended to lease the 80 automatic typewriters now in use. Recurring lease costs in the Department total $209,838 annually. By taking advantage of the lease/purchase option credit of $193,232 which has

accrued toward purchase of the existing equipment in use, funds in the amount of $358,619 would permit immediate conversion from lease to purchase of these machines. However, this would ignore the availability of numerous machines at the marketplace which appear to have features superior to those now in use in the Department. It would also leave the Department with equipment which has substantially performed its useful life. The Department is currently field testing 13 different types of automatic typewriters recently introduced on the open market. The test results will provide a valid basis for determining which machine(s) will best suit the Department's needs at the lowest cost as a further step in the process of producing high volume correspondence in the most effective, efficient manner.

EXHIBIT A

AVERAGE DAILY LINE PRODUCTION

3RD QUARTER, FY 1974

Field Stations	No. of Machines	Avg. No. of Lines Produced Per Day
Baltimore	1	1,011
Boston	1	1,166
Buffalo	1	820
Hartford	1	1,167
Newark	2	2,165
New York	2	1,374
Pittsburgh	1	1,072
San Juan	1	1,336
Togus	1	742
VBO	1	1,198
Atlanta	2	545
Columbia	1	821
Houston	1	2,596
Huntington	1	981
Jackson	1	1,581
Little Rock	1	1,388
Louisville	1	1,099
Montgomery	3	908
Nashville	1	941
New Orleans	1	1,346
Roanoke	1	1,405
Waco	6	183
Winston-Salem	2	908
Chicago	3	828
Cleveland	4	269
Des Moines	1	574
Detroit	1	1,617
Indianapolis	1	1,454
Lincoln	1	936
Milwaukee	1	748
Muskogee	1	1,032
Philadelphia	4	899
Sioux Falls	1	605
St. Louis	1	926
St. Paul	5	643
Wichita	2	586
Albuquerque	1	1,408
Denver	1	881

EXHIBIT A

EXHIBIT A

Field Stations	No. of Machines	Avg. No. of Lines Produced Per Day
Honolulu[1]	1	78
Juneau[2]	1	N/A
Los Angeles	6	345
Phoenix	1	1,022
Portland	2	414
Reno[2]	1	N/A
Salt Lake City	1	1,119
San Diego	1	632
San Francisco	3	1,059
Seattle	1	806

NOTE: The lower volume reflected at some stations which utilize more than one automatic typewriter is due to the fact that only one or two typewriters are used for repetitive typing. The remaining typewriters are use to prepare semi-repetitive and prestige correspondence (power typing). DVB work-rate standards provide a line count only for lines which are repetitive (pattern letters). When the equipment is used for power typing, that work is counted as minutes transcribed/forms and form letters typed.

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[1]Small station. Equipment used primarily for power typing.

[2]No statistics available. Station does not have a centralized transcription activity.

CHAPTER 15

IMPROVED PRODUCTIVITY IN A REGIONAL OFFICE, BUREAU OF LABOR STATICTICS

BACKGROUND

The Bureau of Labor Statistics (BLS) is the government's principal fact finding and research agency in the field of labor economics. BLS collects, analyzes and reports on information concerning wages, prices, employment, productivity, conditions of work, collective bargaining, and job safety and health. Practically all the basic data it collects from businesses, labor unions and other government agencies are supplied on a voluntary basis. Data are normally obtained through personal visit or telephone interviews conducted by BLS field economists in the Regions.

REGIONAL OFFICE OPERATIONS

The Pacific Regional Office, headquartered in San Francisco, collects and reports on economic data for the Western U.S. (all States in standard Federal Regions IX and X). Data collection is the major activity of the regional office--involving directly or indirectly more than half of the full-time staff of 65. At different times over the past eight years 20-30 field economists have been employed to collect information on wage and fringe benefit data directly from employers. In many instances field economists are in travel status and away from the San Francisco headquarters office for weeks at a time. For example, during the Portland, Oregon, Area Wage Survey, four or five field economists may be working in the Portland area for up to six weeks. During this period mail and telephone are the only communication links between the field economists and the Regional Office staff.

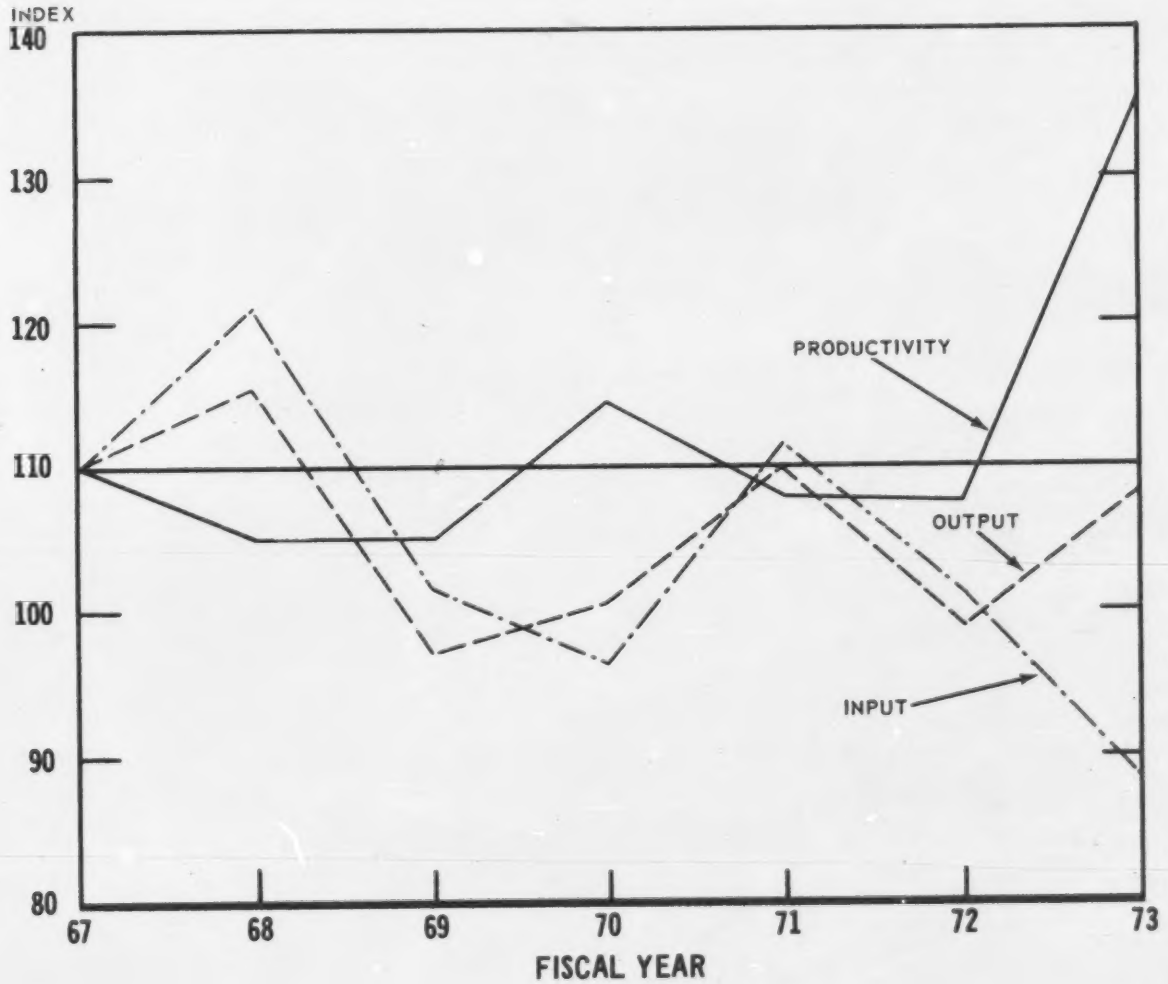
PRODUCTIVITY MEASUREMENT SYSTEM

BLS has compiled input and output records for its direct data collection activities for many years. The output measure

SOURCE: National Commission on Productivity and Bureau of Labor Statistics

available quarterly and on a fiscal year basis shows these input and output data for more than 20 different wage and fringe benefit surveys. However, three of these surveys are repeated every year and constitute the basic "bread and butter" programs. Together the Area Wage Surveys, Service Contract Act Wage Surveys, and the Professional, Administrative, Technical and Clerical Salary Surveys accounted for well over half of all completed schedules and manhours in the wage collection program in FY 1973. The table and graph below show the productivity record for these three basic wage surveys for the last seven fiscal years.

DATA COLLECTION INPUT, OUTPUT AND PRODUCTIVITY INDEXES (1967=100)



DATA COLLECTION PRODUCTIVITY, FY 1967-73

Fiscal Year	Completed Schedules	Output Index	Collection Hours	Input Index	Productivity Index
1973	2,705	98.3	13,512	78.5	125.2
1972	2,450	89.0	15,676	91.1	97.7
1971	2,745	99.7	17,504	101.7	98.0
1970	2,482	90.2	14,855	86.3	104.5
1969	2,394	87.0	15,767	91.6	95.0
1968	2,903	105.4	19,100	111.0	95.0
1967	2,753	100.0	17,213	100.0	100.0

PRODUCTIVITY FINDINGS

As the table and chart above indicate, productivity in the basic wage collection programs jumped substantially in FY 1973. Over the entire period from FY 1967 to FY 1972, the productivity index had ranged from about 95 to 105 (1967 = 100), but in FY 1973 it soared to 125.2--a 28 percent gain in one year. Moreover, the productivity increase was much more rapid in the second half than in the first half of FY 1973; and it continued to rise strongly during the first half of FY 1974. Productivity on the Area Wage and Service Contract Act surveys combined rose 14 percent between the first halves of FY 1972 and FY 1973--and then jumped about 55 percent between the second halves of FY 1972 and FY 1973. (The Professional, Administrative, Technical and Clerical Salary Survey is excluded from the above comparisons because it is not conducted in the first six months of the fiscal year.) From the first half of FY 1973 to the first half of FY 1974, productivity rose another 23 percent on the Area Wage and Service Contract Act surveys. In other words, the healthy productivity gains shown for FY 1973 were not only maintained during the first half of FY 1974, but were increased further.

These sharp productivity improvements were achieved with no apparent diminution in the quality of the data collected. In fact, the staff responsible for reviewing questionnaires completed by field economists says that there was a significant improvement in the data quality in calendar years 1972 and 1973. Some of the reasons for the improved quantity and quality of data collected are discussed in the following section.

REASONS FOR THE PRODUCTIVITY GAINS

Many factors contributed to the dramatic productivity improvements evident in FY 1973 and continued into FY 1974. However, the most basic change was improved two-way communications between the regional office staff and the field economists. During the late 1960's and the early 1970's, the field staff had come to believe that their functions and efforts were taken for granted by the Regional Office management. The fact that the field economists were physically separated from the Regional Office for weeks and months at a time contributed to these feelings. However, in 1971 and 1972 management became aware of several issues that caused discontent among the field staff. Matters such as the uneven assignment of travel to field economists, the lack of incentives for superior performance (i.e., no awards, promotional opportunities or recognition from top management), and the desirability of collecting more data by telephone interview rather than personal visit were recognized.

Gradually over a period of several months a relationship of trust and more open communications developed. This made it possible for several members of the field staff to discuss problems and perceived inequities with management, and management responded by making serious and strong efforts to correct many of the problems. The active interest and response by management in turn contributed to improved field staff morale and to the belief that there were real incentives and recognition available to field economists for high quantity and quality performance. Once the "logjam" caused by poor communications and distrust between the field staff and the regional office staff was broken, the field staff output began its strong and steady rise.

In recent years a growing proportion of all schedules have been completed by telephone interview rather than personal visit. The absolute productivity level for telephone collection (in terms of schedules per hour) is two to three times as high as for personal visit--because only relatively short and simple schedules are collected by phone, and because no travel time is involved. The higher proportion of telephone interviews contributed to the FY 1973 total productivity rise, but in the same year productivity on personal interview collection also showed a substantial increase (15 percent). The productivity increase for personal visit interviews is doubly significant because more than three-fourths of all

schedules are still collected by this method and the volume is increasing on these large, complex and difficult schedules.

Listed below are a number of specific changes that were implemented in calendar years 1972 and 1973, and contributed both to improved morale and productivity on the part of the field economists:

1. Senior field economists were promoted into regional office positions. This helped to destroy the myth that the field staff were "second class citizens" who had little or no chance to obtain the higher graded office jobs that normally require much less travel than the field economist jobs.

2. Rotational details were established so that members of the field staff could spend up to three months working in regional office assignments. These details offered some of the benefits mentioned in item 1 above, and also gave the detailees experience in reviewing completed schedules and editing computer tapes produced from these schedules. This gave the agents an understanding of the problems involved when incomplete or incorrect schedules were submitted and probably contributed to an increased awareness of the importance of quality work.

3. Work was assigned to field economists by the specialist in charge of a particular survey as opposed to the previous system where all work was assigned by the Chief of the Data Collection Branch. This change allowed the survey specialists to maintain close contact with the field staff on the one, two, or three surveys that each specialist was directing. Under the previous system it was virtually impossible for the Branch Chief to keep assignments balanced among 25 or more field economists--inevitably some of the field staff would have more work than they could handle, while others would not have enough to be fully occupied. This change also made it possible for the Data Collection Branch Chief to concentrate more on overall management responsibilities, such as performance evaluations of the field staff.

4. A survey coordinator position was established in Los Angeles in FY 1962. The incumbent made assignments and provided general supervision to field economists collecting data in Southern California and Arizona. As with the change

discussed in item 3 above, this move established closer coordination between the field economists and their supervisor, and made it possible to assign and monitor work on a more personal and up-to-date basis.

5. Outstanding performance by field economists was rewarded with quality step increases, cash awards, and in December 1973 by a Special Achievement Award from the Commissioner of Labor Statistics. This was an extremely important method of establishing incentives and recognition for the field staff.

6. Better long range planning of field staff travel was instituted. Two benefits were achieved here: first, the length of individual trips and the total time away from San Francisco during the year were reduced, and second, travel assignments were arranged to meet the field economists' preferences when possible.

SUMMARY

The specific changes discussed in the preceding section and the secular increase in the proportion of interviews completed by telephone all contributed to the sharp productivity gains recorded in FY 1973 and the first half of FY 1974. However, the underlying reason for improved performance was motivational or attitudinal change that occurred in the field staff when communications between them and the Regional Office were improved. The major obstacle to productivity improvement in previous years was the physical and organizational isolation of the field economists--a feeling on the part of the field staff that Regional Office management was not interested in them personally or professionally. Once management began to respond to some of the field staff suggestions, the feelings of alienation or "second class citizenship" began to diminish. The field economists responded to the more open environment and the recognition opportunities by sharply increasing both the quantity and quality of their output.

In the absence of the recent productivity gains the BLS Regional Office would have needed to hire an additional five field economists to complete FY 1973 and 1974 data collection. Not having to add five new positions to a staff of approximately 25 represents a 20 percent personnel saving. Neither Regional Office management nor the field economists assume that the recent gains will be easy to maintain or improve upon.

However, both groups are working hard to maintain open two-way communications and the feeling that the field economists are a full fledged and important part of the regional office staff--even though they are not in the San Francisco office every day.

CHAPTER 16

IMPROVING PRODUCTIVITY IN NASHVILLE, TENNESSEE

INTRODUCTION

The National Commission on Productivity, in conjunction with the International City Management Association, initiated productivity assessment pilot projects in two cities--St. Petersburg, Florida, and Nashville/Davidson County, Tennessee. The objective of these one-year efforts was to introduce to local officials the concept of productivity measurement and its use in management decisions.

The General Accounting Office provided a management analyst to work on this project in Nashville, Tennessee, for a four-month period. During that time the GAO analyst and a city administrative analyst completed two successful productivity improvement projects in the city's Water and Sewer Services Department. Both projects serve to point out the potential for improvement at the local level and the results that can be obtained if analytical talent is applied to local government problems.

One of the projects was to examine the work assignments and routing plan for reading the City's 84,000 residential and small commercial meters. The present routing system had become outdated due to urban renewal, highway construction, and new residential construction over the past year. Micro routing techniques and the work week unit concept were evaluated and applied during a field test. The results indicated that a manpower savings of about 20 percent, or $20,000 per year, could be attained.

The other project dealt with the alternatives involved in replacing mechanical drive water meters. The analytical approach taken to solve this problem and the implementing steps are described in depth.

WATER METER ACQUISITION PROJECT

Nashville's Department of Water and Sewer Services was faced with the same problem as many other water systems across the country--to continue the repair of 80,000 old mechanical drive water meters or to replace them with a new type meter.

A recent technological innovation in measuring water usage is a magnetic drive water meter that has been perfected within the last 10 years. This meter has two major advantages over the old mechanical drive meter--lower repair rates and greater metering accuracy due to its fewer moving parts and sealed register. Recently, several cities reported favorable experiences with systems composed of the magnetic drive meter. Memphis, Tennessee, Nashville's sister city, has begun implementing a ten year replacement program of their old mechanical drive meters with the new meter. Also, the price of these new meters has dropped within the last year to its lowest point ever. The Department was also faced with the problem that 20,000 of the old mechanical drive meters do not have replacement parts available since the manufacturer has recently gone out of business. Exhibits I - IV at the end of this chapter illustrate the advantages of the magnetic drive meter and the difficulties involved in repairing the mechanical drive meters.

In light of the positive benefits of the new type meter and the parts problem of 25 percent of the total residential meters, the Department of Water and Sewer Services realized an evaluation of alternative replacement plans was necessary. The Department then requested the Department of Finance's Program Analysis Section to evaluate the problem and determine the best alternative. An administrative analyst from this section and the GAO management analyst were assigned to perform the evaluation.

The method of evaluation chosen by the analysts' was a cost-benefit analysis of three alternative meter changeout programs over a 15 year time period.

The alternative replacement plans were:

(1) Replacing those 20,000 meters whose replacement parts had been discontinued and then only replacing the remaining mechanical drive meters at a rate of 1,000 per year. This plan would have been implemented if no evaluation of the system had been done.

(2) A 10 year replacement plan similar to the one adopted by Memphis. The mechanical drive meters would then be replaced at a rate of 8,000 per year for ten years.

(3) A four year accelerated plan that would require replacing 20,000 meters per year.

The costs evaluated for each alternative were (1) the capital costs of new meters and equipment, (2) meter repair costs, and (3) the installation costs of the new meters.

There are two quantifiable benefits of the magnetic drive meter--its accuracy savings and improved readability. The readability benefit could not, however, be evaluated in this analysis since there exists no area in Nashville that has predominately magnetic drive meters. Therefore, no time study comparisons between reading magnetic drive and old mechanical drive meters could be made. The only benefit evaluated was the accuracy benefit of the magnetic drive meter. A sophisticated sampling technique was used to evaluate this benefit.

This benefit and the three costs were evaluated for the three alternative replacement plans over a 15 year period. The results of this analysis are shown in the following table.

BENEFIT/COST ANALYSIS

	Alternatives		
	Gradual	10 years	4 years
Capital Outlay	$ 846,150	$ 2,189,590	$ 1,985,270
Installation	856,275	751,996	528,650
Repair	2,360,070	1,599,310	1,605,322
Total costs	4,062,495	4,540,896	4,119,242
Accuracy savings	-832,705	-2,113,719	-2,656,144
Net costs	$3,229,790	$ 2,427,177	$ 1,463,098

These results show that the four year accelerated replacement plan would save the city almost $1.8 million over the gradual replacement and about $10 million over the ten year or Memphis plan.

The net costs, however, cover a fifteen year period and neither the present value of money nor inflation had been taken into consideration. In order, therefore, to more realistically compare alternatives, the cost and benefit streams for each alternative were inflated and then discounted to present value.[1] [2] The estimated savings that could be achieved by employing the four year alternative are shown below.

COMPARISON OF ALTERNATIVE SAVINGS

Expected Net Savings From 4 years	Total Net Savings	Present Value[1] [2]
Over gradual plan	$1,766,490	$796,481
Over 10 year plan	$ 964,079	$483,179

APPROVAL PROCESS

After the completion of the analysis, the next step taken by the team was a presentation of these results to the key personnel of the Water and Sewer Department. They did not have any problems with the method of evaluation and accepted the recommendation of the accelerated four year replacement plan.

It was then determined that a presentation should be prepared for the upcoming water and sewer bond hearings before the city council. The request to the council was for $1 million in this bond issue with the understanding that a similar amount would come from the 1976 water revenue bond.

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[1] These cost have been inflated using appropriate Bureau of Labor Statistics Information.

[2] A 5 percent rate is presently used by the Water and Sewer Department for Revenue bonds and was used as a discount factor in the analysis.

Metropolitan Nashville's city council is quite unlike many city councils due to its size of membership. At present there are 40 council members not including the mayor. In order to conduct business, these councilmen serve on committees of 5-15 members with each member serving on 2 to 3 committees. The water and sewer bond issue is normally first discussed in a joint committee meeting of the Budget and Finance Committee and the Public Works Committee and then passed on to the entire Council for approval.

Approximately one month after the Department's acceptance of the water meter recommendation, a presentation was given to this joint council committee. The presentation consisted of a 15 minute slide projector pre-recorded show expounding on the benefits and costs of the new meter system versus the present system and detailing the results of the analysis. The joint committee members decided to accept the capital request and include it in the upcoming revenue bond.

The final step in the procedure was the approval of the $41 million water and sewer bond by the entire council. At this council meeting the revenue bond, which included provision for the water meter acquisition, was passed by a majority vote. Since this was a regular request, it did not require passage by the voting public.

The Water and Sewer Department, along with the help of the analysts, is now in the process of detailing the bid requirements for the first two years of the replacement program. Only three manufacturers of the magnetic drive meters have met Nashville's rigorous performance standards. In order to aid the Department in this final decision on the meter brand, samples of the three types of meters that have been in Nashville's system for about six years were removed and tested for accuracy. These results will determine if there is any significant accuracy difference in brands.

CONCLUSIONS

From the viewpoint of the program analysis staff and the Water and Sewer Department, this cost-benefit analysis proved to be a very worthwhile effort. The total time spent on the evaluation was approximately 4 man-months and it yielded a savings of about $800,000, over a 15 year period

or $53,000 per year. There is a tremendous potential at the local level for more of this type of analysis in identifying and selecting alternative solutions to local government problems.